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THE PRESENT RELATIONS OF SCIENCE AND RELIGION

T. G. BONNEY, SC.D., F.R.S.

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BY THE REV. PROF.

T. G. BONNEY, Sc.D., F.R.S

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EDITOR'S GENERAL PREFACE

IN no branch of human knowledge has there been a more lively increase of the spirit of research during the past few years than in the study of Theology.

Many points of doctrine have been passing afresh through the crucible; "re-statement" is a popular cry and, in some directions, a real requirement of the age; the additions to our actual materials, both as regards ancient manuscripts and archaeological discoveries, have never before been so great as in recent years; linguistic knowledge has advanced with the fuller possibilities provided by the constant addition of more data for comparative study; cuneiform inscriptions have been deciphered, and forgotten peoples, records, and even tongues, revealed anew as the outcome of diligent, skilful and devoted study.

Scholars have specialized to so great an extent that many conclusions are less speculative than they were, while many more aids are thus available for arriving at a general judgment; and, in some directions at least, the time for drawing such general conclusions, and so making practical use of such specialized research, seems to have come, or to be close at hand.

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It thus seems an appropriate time for the issue of a new series of theological works, which shall aim at presenting *a general survey* of the present position of thought and knowledge in various branches of the wide field which is included in the study of divinity.

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The Editor desires it to be distinctly understood that the various contributors to the series have no responsibility whatsoever for the conclusions or particular views expressed in any volumes other than their own, and that he himself has not felt that it comes within the scope of an editor's work, in a series o this kind, to interfere with the personal views of the writers. He must, therefore, leave to them their full responsibility for their own conclusions.

Shades of opinion and differences of judgment must exist, if thought is not to be at a standstill—petrified into an unproductive fossil; but while neither the Editor nor all their readers can be expected to agree with every point of view in the details of the discussions in all these volumes, he is convinced that the great principles which lie behind every volume are such as must conduce to the strengthening of the Faith and to the glory of God.

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PREFACE

DURING the last seventy or eighty years the advance in scientific knowledge has been without a precedent in the world's history. How far, then, has this deepened and broadened knowledge affected our belief in a Creator and Ruler of this world, in One Who not only is an omnipresent and omnipotent Ruler, but also cares for all, can sympathize with their sorrows and pity their infirmities? And if it be that the inferences from this knowledge make for theism, we must further ask what effect they have produced on our attitude to religions which claim to be supported by revelations, and above all on our faith as Christians?

In the following pages I have endeavoured to offer, so far as the necessarily restricted limits permit, some answer to questions of this nature. The first chapter gives a brief account of the more recent discoveries in physics and chemistry, and shows that they suggest a process of evolution on the inorganic as well as on the organic side of nature. The next one gives a short history of the latter and of how it has passed, during the last sixty years, from the position of an hypothesis to that of a theory which, however, may still be in some respects incomplete. A similar process, as we can see from history, is exhibited in ideas of religion, but in them a difference is manifest; for they assume, as a rule, the communication of knowledge from the invisible controlling Power to mankind. Hence, in their case, it must be considered how far that is probable, and, if it be so, whether the claims for acceptance, which are

made by Christianity, can be regarded as valid. Here I have endeavoured to show that the advance of scientific knowledge has rendered some form of theism more probable instead of the reverse, and has not increased the difficulties which are inherent in Christianity, though the history of this demands a belief in certain incidents which are not in accordance with the ordinary laws of Nature.

Recent progress in science has been so great that no one can now claim an intimate knowledge of more than a limited field in it. Thus, though I have kept myself acquainted with its more important results, I cannot venture to speak as an expert outside the particular branch at which I have worked. I have therefore preferred, in dealing with these results, to quote from some recognized authority rather than put his opinion into my own words ; for thus, mistakes about his meaning and unconscious misrepresentations are more easily avoided. I have also omitted, though conscious of the defect, any direct reference to such important aspects of the subject as the psychological and the metaphysical ; the former (so far as they are separable) because, though psychology is rapidly developing and soon to take a prominent position, the time has not yet come when we can appeal to it with so much confidence as to physics, chemistry and biology ; the latter, because I have followed a common practice in limiting the term science to the results of inductive reasoning from observation. Most workers in the latter field assume at the outset that, if proper precautions are taken, they can trust the evidence of their senses, and thus do not trouble themselves about the differences and relations of apparent and ultimate realities, of the phenomenal and the noumenal. The philosophy of science and of religion lie outside my present purpose, and had I attempted to deal with these, I should have been like the youthful David in the panoply of

Saul. Questions of this kind never attracted me, perhaps because, on turning to them after a considerable experience of mathematics, I could not help feeling uncertain how far the tower of deductive reasoning rested on a solid foundation. It is partly on this account —the prominence given to metaphysics—that I have made so little reference to that remarkable book, ' Creative Evolution ' (*Évolution Créatrice*), by Professor Henri Bergson.

The remaining part of the book is devoted to a sketch of the past relations of the pioneers of science and the advocates of some form of Christianity. The latter have often claimed an authority over the former which cannot be justified, because, as history shows, in almost every great dispute they have taken up a position from which the force of facts has ultimately dislodged them ; so that a lasting peace can only be obtained when they have frankly admitted past errors and recognized that the theological and the scientific provinces are generally separate and independent.

I cannot hope that what is said on these matters will give satisfaction to the extremists of either party ; nevertheless, I trust that the facts which I have cited are sufficient to justify my contention that history gives no support to any claims to a corporate or an individual infallibility, and shows that neither personal holiness nor self-sacrificing zeal can qualify any one to pronounce a judgment in matters which he has not studied. It therefore follows that theologians, even on their own subject, cannot demand any higher position than that of experts, and that whenever they have sought greater power than this, the results have been disastrous.

Quite early in my life I realized that the relations of theology and science demanded readjustment. I had, therefore, to consider whether allegiance to the one involved hostility to the other, or whether it was not

possible, in this case, to serve two masters: or, to put it more accurately, whether the two were not really one. The results are expressed in the later part of this book. These, though no doubt nearly everything may have been said by somebody, somewhere, have, to a large extent, been thought out for myself (though I have not neglected the writings of leading theologians) during the quieter hours of a hard-worked life: portions of them have been, from time to time, embodied in addresses and sermons, and it is only fair to say that they have apparently been more acceptable to my fellow-workers in science than to the majority of my brother clergy. I can hardly expect that this book will meet with any better fate. I know from nearly half a century's experience that the 'bearer of ill news,' the teller of unwelcome truths, the dispeller of pleasant illusions, 'hath but a losing office,' and I have become familiar with the image and superscription of the coin given in payment for such services. This, however, I can say: that my belief in the great Christian verities—I mean those embodied in the two great creeds of the Catholic Church—is stronger than ever it was, though I shrink from some of the attempts to formulate doctrines which are beyond human comprehension, and am convinced that, in some branches of this Church, development, as it is called, is often more suggestive of atavism than of evolution.

Perhaps I should add that any coincidences of thought or expression between this volume and the deeply interesting collection of essays, entitled 'Foundations,' are undesigned, for the latter book was not read until the manuscript of this one was finished. I generally abstain from looking at any book which appears while I am writing, if it is likely to take a line similar to my own; for I find that to know what others have just been saying hampers more than it helps me.

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THE PRESENT RELATIONS OF SCIENCE AND RELIGION

CHAPTER I

RECENT ADVANCES IN PHYSICAL SCIENCE

THE last century has witnessed an advance in almost every branch of science which is without a parallel in the history of the world. New or greatly improved instruments of research, such as the spectroscope, the microscope and the galvanometer—to name only three of the most familiar—have made it far more easy to investigate many secrets of nature which baffled the questioning of our forefathers. It is now possible to ascertain the composition, not only of our own sun, but even of distant stars, to watch the working of the invisible, to reveal mysterious changes in the composition of matter, and to trace life back to its beginning in the most minute and rudimentary cell; in a word to sweep with the searchlight of knowledge an area once dark, but of which the boundary is now daily receding. How have these changes affected our religious opinions? Have they made it easier or harder to believe in the existence of a God and Father of all, in the Christ in Whom myriads of our race have put their trust for well-nigh nineteen centuries, or will the ideas of a personal God, and the faith in a risen

Saviour take their place among the illusions of the past, and become for our descendants mere stepping-stones on man's ascent to higher things in his mental progress ? Such questions have been and are being asked ; they are inevitable and we must face them honestly. The days are ended when doubts can be set at rest by the decrees of ecclesiastical assemblies or banished by authority, whether priestly or pontifical. Such a question as Can I believe ? may, however, fairly be met by the counter question In what ? and this obviously admits of a great variety of answers. But these may be grouped in two categories ; the one, ' Is the progress of science in favour of Theism or of Atheism ' ; the other, ' Does this progress increase or diminish the probability of those events, which may be called the foundation stones of the creed of Christians ? ' These questions are obviously separate and distinct. It would be quite possible to answer the first in the affirmative and the second in the negative. We must therefore keep them apart as far as possible ; though, of course, it would be idle to discuss the second one if the first were decided in favour of atheism. But we could have no difficulty in becoming earnest believers in a Divine Ruler of the world, in a God and Father of all, without being satisfied with the evidence in favour of Christianity. Judaism, which still counts very numerous —perhaps over seven million—adherents not less sincere in their convictions than they were nineteen centuries ago, is a living witness in favour of that possibility.

In regard to the first question, since our subject is the present relations of science and religion, we need not discuss either the opinions of ancient philosophers or the gradual advances in science which were made prior to the

eighteenth century, as the result of more careful observation and by reasoning more strictly inductive. In a later chapter it may be necessary to refer to the conflicts which have occurred, and may again break out, between those who claim to be representatives of the one side or the other, but at present it will suffice to take up the story at those points from which modern science, physical and biological, may be said to start. Each of these branches, as was only to be expected, passed through a long period of uncertainty and inconclusive experiment, but as the instrumental aids to research improved, and the results of observation accumulated, phantoms of the imagination were exorcised, idols of the cave were shattered, trustworthy materials were obtained for logical treatment, and hypotheses by long and careful trial were converted into theories.

Modern chemistry was born rather more than a hundred years ago, from the brain of John Dalton.[1] It is quite true that centuries before his date, sundry philosophers had maintained an atomic constitution in matter, while Sir Isaac Newton had stated that he deemed it probable " that God in the beginning formed matter in solid, massy, hard, impenetrable, moveable particles, of such sizes and figures, and with such other properties, and in such proportion, as most conduced to the end for which He formed them ; and that these primitive particles, being solids, are incomparably harder than any porous bodies compounded of them ; even so very hard as never to wear or break in pieces. . . . Now, by the help of these principles, all material things seem to have been composed of

[1] See *John Dalton and the Rise of Modern Chemistry*, by Sir H. E. Roscoe, The Century Science Series, 1895.

the hard and solid particles above mentioned." [1] Thus Dalton was not the first, nor did he ever claim to be, who proposed an atomic theory of matter, but to him "the honour of founding a *chemical* atomic theory is to be ascribed. It was he who first explained the *facts* of chemical combination by a theory which has stood the test of time, and is not contradicted by any known phenomenon of chemical action." [2] Dalton showed that these ultimate particles (which, of course, could not be seen or separately weighed, and which could only be estimated by their physical properties) combined in obedience to definite laws of weight and volume. They were named 'atoms,' as being incapable of any further division, and their simpler combinations were called molecules. Thus all substances, whether solids, fluids, or gases, might be said to have a 'grained' structure; their grains being atoms or molecules, as it might happen. On the foundation laid by Dalton, chemistry, during the remainder of the nineteenth century, was built up.

The number of distinct atoms, or elements, has been increased by the discovery of new ones, from about sixty to at least eighty: "the progress of synthesis, or the building up of natural materials from their constituent elements, proceeds apace. Even some of the simpler albuminoids, a class of substances of great importance in the life process, have recently been artificially prepared. . . Innumerable entirely new compounds have been produced in the last century. The artificial dye-stuffs, prepared from materials occurring in coal-tar, make the natural colours

[1] *Ut supra* (quoted), p. 128.

[2] This sentence, published in 1895, would now require to be somewhat differently expressed, though it is still practically true.

blush. Saccharin, which is hundreds of times sweeter than sugar, is a purely artificial substance. New explosives, drugs, alloys, photographic substances, essences, scents, solvents and detergents are being poured out in a continual stream." [1] This has been accomplished, as a result of modern chemistry, although during the last forty years revolutionary changes have been introduced into our conceptions of the molecule and the atom by the alliance between chemistry and the other branches of physical science.

The results of these may perhaps be better appreciated by briefly tracing the more important forward steps in the modern conception of matter. They may be described as efforts to discover a unity, or at least a very great simplicity, underlying the apparent diversity which we mentioned in referring to Dalton's work.

One of the most important was a consequence of the wave-theory of light, advocated by Huygens so long ago as 1678, which was placed on a firmer basis by Thomas Young, almost simultaneously with the publication of Dalton's atomic theory of matter, and so far developed by Fresnel, that, before the middle of the last century, it had been generally accepted. But this theory evidently required that throughout interstellar space, between ourselves and at least the most distant stars, a something should exist to transmit the undulations which, when they impinge upon our eyes, produce in us the sensation of light. The amplitude of the waves in this ' something ' and their rate of propagation have been measured, with the result of ascertaining that light travels *in vacuo* (in which, however, the vibrating material must be present) at the amazing

[1] F. Soddy, *Matter and Energy*, p. 45 (N.D. but after 1900).

rate of 186,772 miles a se cond, and a little more slowly through air.

In addition to this, great improvements in optical instruments have enabled physicists to study the spectra of the sun, the stars, and terrestrial elements, and to make, after the beginning of the last century, such numerous and astonishingly rapid advances, that almost all the constituents of the visible universe have now been identified. A number of investigators, among whom (to mention only our own countrymen and of these such as have ceased from their labours) Kelvin, Maxwell and Stokes stand in the front rank, have shown that the presence of any element, however minute the quantity, may be detected, not only in all terrestrial substances but also (though in an incandescent state) in the sun and the most distant stars, in which we can behold worlds in the making. This universally intervening ' something,' to which we must presently refer more fully, must be endowed with other functions than the transmission of light ; it must also, as we shall see, be intermediary to the action of gravitation—that influence or force, as it is popularly called, which regulates the movements of all the members of our solar system and probably of all like systems in other parts of the universe.

But what is this something ? For many years past students of physical science have been seeking for an answer to this question and they tell us, giving good reasons for their statement, that it must be a medium which, in order that it may transmit the disturbances or waves that produce on us the impression of light, must possess two properties, the one elasticity, in order to store up energy and prevent recoil, the other what is called

inertia—namely that which enables it, when disturbed, to overshoot the mark and oscillate to and fro on either side of its position of equilibrium. By energy, as we shall presently see, is meant the power of doing work (the latter term being used in a wide sense) and the significance of the phrases may be made clearer by a simple illustration. Suppose a ball to be suspended from a fixed point by an elastic cord, drawn by the hand for a little distance downward from its position of rest, and then released. It will spring up to some point above that position and then bob up and down about it, until the energy acquired by its displacement has been expended, and at the end of a number of oscillations, gradually becoming less and less, it is again motionless. Whatever the property in the ball may be, it does not affect our sense of touch, or resist motion in the slightest degree. Sir O. Lodge, after a series of the most delicate experiments, satisfied himself that the ether not only offered no resistance to the passage of bodies through it, but also was not in any way caught up and carried along by our earth, as it whirls about either its own axis or the sun. He could not find a trace of mechanical connexion between matter and ether of the kind known as viscosity or friction.[1] But experiments demonstrating that it is capable of transmitting those wave-disturbances which are known as light, electricity and heat, prove the ether to be, not a fanciful speculation, like one of those in which the ancient alchemists indulged, but something very real. Enough also has been ascertained about it to show that we should not be justified in assuming an agnostic position. It must, for instance, be capable of transmitting mechanical action.

[1] Sir O. Lodge, *The Ether of Space*, p. 26 and ch. v. (1909).

As the above-named writer remarks "A body can only act immediately on what it is in contact with; it must be by the action of contiguous particles—that is, practically, through a continuous medium, that force can be transmitted across space. Radiation (of light and heat) is not the only thing the earth feels from the sun: there is in addition its gigantic gravitative pull, *a force or tension more than what a million million steel rods, each seventeen feet in diameter, could stand.* What mechanism transmits this gigantic force? Again, take a steel bar itself: when violently stretched, with how great tenacity its parts cling together. Yet its particles are not in absolute contact, they are only virtually attached to each other by means of the universal connecting medium—the ether—a medium that must be competent to transmit the greatest stresses which our knowledge of gravitation and of cohesion shows us to exist."

This brings before us another remarkable relation of the ether to the bodies which we call material. Though invisible to sight, impalpable to the touch, imperceptible by any of our senses, it must be a substance of extraordinary solidity.

A quotation from an address by Sir J. J. Thomson [1] puts this difference in a striking form. After speaking of that characteristic of the ether, he proceeds: "At first sight the idea that we are immersed in a medium almost infinitely denser than lead might seem inconceivable; it is not so if we remember that in all probability matter is composed mainly of holes. We may, in fact, regard matter as possessing a bird-cage kind of structure,

[1] *British Association Report*, 1909 (Winnipeg), p. 17.

in which the volume of the ether disturbed by the wires when the structure is moved is infinitesimal in comparison with the volume enclosed by them. If we do this, no difficulty arises from the density of the ether: all we have to do is to increase the distance between the wires in proportion as we increase the density of the ether." In this respect material substances, whether gases, fluids, or solids, differ from the ether, that they are assemblages of particles with gaps between them, while it "is 'all there,' everywhere, without break or intermittence of any kind. They are merely an aggregate of separate individuals, while it is a *continuum*, which does not admit of distinction or separation."

We come next to the question of what this ether may be, with which we are really so familiar, by which we are at least pervaded, and from which we may be constituted. We may approach this by considering another group of phenomena, those of electricity.

It has long been known that when a certain substance (say, a stick of sealing-wax or bit of amber) is rubbed for a while with some other one, such as a woollen cloth, it will attract one of a third group, for instance, a bit of paper: that is to say the work done, which is an expenditure of energy (or the power of doing work) so transforms that energy, as to render it capable of producing effects, which bring the first and third substances into a new relation. They are "electrified." To obtain the more marked effects, special substances must be selected for the experiment, and these will be found also to attract one another. But suppose that we take two pieces of resin and two of glass (as more handy for our purpose than a woollen cloth) and rub together a piece of each.

The two components of either pair acquire a power of mutual attraction, but if the two pieces of resin or the two pieces of glass be brought together, they repel instead of attracting each other. Further experiment shows that bodies which are similarly electrified are mutually repellent, and those which are oppositely electrified (like the rubber and the rubbed) are mutually attractive. This indicates the existence of two forms of electricity, opposite to each other, the one of which is called positive and the other negative; bodies which are in opposite electrical condition attracting and those which are in the same repelling one another. It is also found that the substance attracted by an electrified body, such as the piece of paper in the first instance, is electrified similarly to the attracting body. But only certain substances are capable of acquiring this property from another; these accordingly, are called conductors: the rest being non-conductors, so that it becomes possible to insulate a body which has become electrified; that is, to prevent it from passing on its acquired charge of electricity. Students of electrical physics have come to the conclusion, as the result of a long series of delicate experiments, that the electric current, as it is called, can be transmitted not only through solids fluids, and gases, in some of which it produces marked chemical changes, but also through a vacuum (readily, in the case of a negative current, but with great difficulty in that of a positive one). Thus the ether alone, when apart from ordinary matter, is capable of transmitting an electric current, and the extremely small particles, which are the vehicles of transmission, are considered to be nothing else than charges of electricity quite free from ordinary matter. These are called electrons, and we

shall presently perceive their importance, as a connecting link, if the phrase be permissible, between ether and matter.

To see how this has come to pass, we must go back in the history of the atom for some forty years. Doubt had then begun to arise whether the several elements of the chemist were really anything more than substances which had not yet been decomposed, and as Faraday once said " to decompose the metals, to reform them, to change them from one to another, and to realize the once absurd notion of transmutation, are the problems now given to the chemist for solution." As stated by W. Crookes [now Sir W. Crookes, O.M.], in his singularly suggestive address to the Chemical Section of the British Association in 1886, " Mr. Norman Lockyer [now Sir Norman Lockyer, K.C.B.] has shown, I think on good evidence, that in the heavenly bodies of the highest temperature, a large number of our reputed elements are dissociated, or, as it would perhaps be better to say, have never been formed. Mr. Lockyer holds that 'the temperature of the sun and the electric arc is high enough to dissociate some of the so-called chemical elements, and give us a glimpse of the spectra of their bases' " ; and he goes on to say that " a terrestrial element is an exceedingly complicated thing that is broken up into simpler things at the temperature of the sun, and some of these things exist in some sun-spots while other constituents exist in others." Crookes also, after discussing the atomic weights of the elements and their mutual relations, makes these significant remarks : " Let us picture the very beginnings of time, before geological ages, before the earth was thrown off from the central nucleus of molten fluid, before even the sun

himself had consolidated from the original *protyle*.[1] Let us still imagine that at this primal stage all was in an ultragaseous state, at a temperature inconceivably hotter than anything now existing in the visible universe; so high indeed, that the chemical atoms could not yet have been formed, being still far above their dissociation-point. . . . But in course of time some process akin to cooling, probably internal, reduces the temperature of the cosmic *protyle* to a point at which the first step in granulation takes place; matter, as we know it, comes into existence and atoms are formed. As soon as an atom is formed out of *protyle*, it is a store of energy, potential (from its tendency to coalesce with other atoms by gravitation or chemically) and kinetic (from its internal motions). . . . The easiest formed element, the one most nearly allied to the *protyle* in simplicity, is first born. Hydrogen—or shall we say helium?—of all the known elements the one of simplest structure and lowest atomic weight, is the first to come into being. For some time hydrogen would be the only form of matter (as we now know it) in existence, and between hydrogen and the next-formed element there would be a considerable gap in time, during the latter part of which the element next in order of simplicity would be slowly approaching its birth-point; pending this period we may suppose that the evolutionary process, which soon was to determine the birth of a new element, would also determine its atomic weight, its affinities and its chemical position."[2]

[1] By this word he designated 'the original primal matter, existing before the evolution of the chemical elements.' It is formed from the Greek words *protos* (first) and *hyle* (stuff of which things are made) and so should have been written *prothyle*.

[2] *British Association Report*, 1886 (Birmingham), pp. 559, 568.

Progress was rapid during the next fourteen years, as may be seen from Larmor's masterly address to another section of the British Association in the closing year of the nineteenth century.[1] In this he discusses the part played by the ether in the transformation of energy as well as its transmission across the celestial spaces, and indicates that " the material atom must be some kind of permanent nucleus that retains around itself an ethereal field of physical influence, such as, for example, a field of strain." He refers also to J. J. Thomson's experimental investigations into the molecular constitution of the chemists' atom. These clearly showed (in 1897) that " in the cathode rays of a vacuum tube we can detect corpuscles possessing about one-thousandth part of the mass of the lightest atom known to chemistry—that of hydrogen. These corpuscles were shown to be identical, whatever the nature of the residual gas in the tube, and whatever the metal employed as electrode. The corpuscles are common to all kinds of matter, and the mind at once sees in them the long-sought ultimate basis from which all atoms are made."[2] This " corpuscle of J. J. Thomson, the electron of Stoney, Larmor and Lorentz, is represented in the ethereal world by Larmor's conception of a centre of intrinsic strain. Unlike the vortex atom, this strain-centre is not a part of the medium for ever separated from the rest; the strain alone persists, the part of the ether which is affected by it constantly changes as the sub-atom is moved. The ether is stagnant, and the sturdy ghosts which constitute matter, float to and fro

[1] Now Sir J. Larmor. See *Report*, 1900 (Bradford), p. 613.

[2] W. C. D. Whetham, *The Recent Development of Physical Science* (1904), p. 255.

through it as waves pass over the surface of the sea. . . . According to this view, then, an electron or unit charge of electricity is a centre of intrinsic strain, probably of a gyrostatic type, in an ether which is also the medium in which are propagated the waves of light and wireless telegraphy. Moreover, the electron is identical with the sub-atom which is common to all the different chemical elements, and forms the universal basis of matter. Matter, at any rate in its relation to other matter at a distance, is an electrical manifestation ; and electricity is a state of intrinsic strain in a universal medium. It is prior to matter and therefore not expressible in terms of matter ; it is sub-natural if not super-natural." [1]

Enquiry may be made as to the size of the corpuscle. Mr. Whetham answers the question in the following passage, "We have already seen that in a substance like water, where the molecules are fairly closely packed, one cubic centimetre [2] contains about 3×10^{22} molecules, or, let us say, 10^{23} atoms. Along each edge of the centimetre cube about 4×10^{7} atoms are ranged, and thus we may take the effective radius of an atom to be about 5×10^{-8} of a centimetre. The volume would be about 10^{-23} of cubic centimetre, while the volume of an electron, according to the above estimate of the radius, is about 4×10^{-39}.[3] Thus, while the diameter of an electron is less than the hundred-thousandth part of that of an atom, the volume of an electron is only about the 10^{-16} part of that of an atom, and their relative sizes have been compared by

[1] W. C. D. Whetham, *The Recent Development of Physical Science*, p. 280.

[2] A centimetre is ·3937 of an inch, i.e., about four-tenths.

[3] That is to say, a fraction with 4 as its numerator and 10 multiplied by itself 38 times as denominator.

the illustration of a mouse roaming about inside a cathedral." [1]

We must not, however, imagine these corpuscles, the components of an atom, to be "locked together in a closely-packed conglomerate, but moving in oscillatory or orbital motion under the influence of their mutual forces." What may be the exact nature of that motion, and of their arrangement, is still under investigation, but on these questions we need not dwell for they do not affect the main principle, viz. that if we accept the theory of electrons and the phenomena of radiation, presently to be mentioned, we may "suppose that the electrified corpuscles—the electrons—are in rapid orbital or oscillatory motion within the atom: that, for example, the electrons whirl round in their orbits as the planets swing round the sun." [2] Thus our conception of the atom as something indefinably hard and solid, the most persistent and immutable thing that exists in nature, is changed into a separate system of moving units—something like, but much more complex than, that of which our own earth is a member, though every part of it is diminished to an extent which may be inferred from the statement quoted in the last paragraph. The mutual movements and relations of these units may be stable under ordinary circumstances and the forms of stability may be different. The number of the latter also may be comparatively small, because if we assume the existence of any chance 'jumble' of corpuscles, each following its own path and colliding with others, such an aggregate would, as a rule, be unstable and would but slowly attain to the condition necessary for stability.

[1] W. C. D. Whetham, *The Recent Development of Physical Science*, p. 283.

[2] *Id.*, p. 186.

Each, then, of the known atoms would be an aggregate of corpuscles, which has arrived at one of those conditions in their internal relations that alone can produce stability. As the conditions are different one from another, they may severally endow the particular system with those properties which distinguish it from others. Its stability also, when once attained, would remain undisturbed, unless it were acted upon by some external force (as experience shows it to be with our own solar system) or were in some way or other capable of internal disintegration. The latter, as we shall now see may happen in certain cases, which apparently justify the inference that the stability of some systems (i.e. atoms) is less than that of others.

We must now go back to the year 1895, when C. W. Röntgen, of Würzburg, announced a discovery which has proved to be the starting point for a series of advances that have effected something like a revolution in our conceptions of matter. It was that "when a vacuum tube was so highly exhausted that the walls of the tube became vividly phosphorescent during the continuance of the discharge, rays, which were propagated in straight lines, were emitted into the space outside the tube.[1] He found that a plate covered with a phosphorescent substance, such as potassium platino-cyanide, became luminous when interposed in the path of these rays, and that the interposition of various solids between the tube and the plate gave rise to shadows of greatly varying intensity,

[1] These, referred to as X-rays, are produced by the sudden impact of the electrons within the tube on its walls. The more suddenly they are stopped, the more penetrating and remarkable are the X-rays produced. Soddy, *ut supra*, ch. vi.

the depth and sharpness of the shadow being greater, as a general rule, the greater the density of the interposed substance: thus, for example, when a hand was placed between the tube and the plate, the outlines of the bones became distinctly visible in the shadows cast upon the screen owing to the bones casting much stronger shadows than the surrounding flesh. When a closed wooden box containing pieces of metal was employed, the outlines of the metal were distinctly shown, the metal casting a very deep shadow, and the wood only a comparatively slight one. The rays were also found to affect a photographic plate, so that shadow photographs could easily be obtained."[1]

In 1896 Henry observed that sulphide of zinc, after it had been rendered phosphorescent by exposure to the light of the sun or incandescent magnesium, could produce an effect on a photographic plate through a screen made of black paper or aluminium, if thin enough. A little later in the same year Becquerel discovered that similar effects were produced by certain non-phosphorescent substances. After testing Henry's discovery on compounds of other metals than zinc, he experimented with some uranium nitrate, the cystals of which had been formed in the dark from a solution of that material. Obviously these had never been through a state of phosphorescence, and yet they produced the wonted effect on protected photographic plates. From this he inferred that the effect was really due, not to phosphorescence but

[1] *A Treatise on Electrical Theory* by G. W. de Tunzelmann (1910), p. 109. This discovery, as may be inferred, has proved to be of very great practical value to mankind in a large number of cases, more especially those requiring surgical aid.

to some property of the mineral uranium. This discovery led the way to a group of others far-reaching in their importance.

In these Ernest Rutherford, born in New Zealand, and educated first in its University and then at Cambridge, has taken the lead, and among them one of the most remarkable has been that three kinds of rays are emitted by a substance which has the property of radio-activity, as it is now termed. They are called respectively, alpha-rays, beta-rays, and gamma-rays. "The alpha-rays are among the most feebly penetrating of the new kinds of radiation, and are absorbed by a single sheet of paper or by a few inches of air." [1] The beta-rays are the more obvious on first examination, "for they affect the photographic plate powerfully and are capable of traversing metallic foils." They are regarded as free-flying single negative electrons, but their velocity is, in some cases, that of light itself, the fastest that is known. The gamma-rays (the latest to be observed) are very feeble by comparison, but their penetrating power is far the greatest of any known kind of ray. They "traverse half an inch of lead before being half-absorbed and other substances, roughly in proportion to their density."

Becquerel's discovery suggested that radio-activity might not be restricted to uranium and its salts, so other materials were investigated. Two years later Schmidt and Madame Curie independently discovered that the same property belonged to thorium and its salts, but the phenomena exhibited by these "were of a much more complex character than those observed

[1] F. Soddy, *ut supra*, p. 205.

in the case of uranium." Further study of pitchblende,[1] the chief source of that metal, brought to light "three distinct and strongly radio-active metals; radium, discovered by Monsieur and Madame Curie and Monsieur Bémont; polonium, discovered by Monsieur and Madame Curie; and actinium, discovered by Monsieur Debierne."[2]

It has been noticed already "that a radium compound maintains itself continuously at a temperature several degrees above that of the surrounding atmosphere," a fact which led to the inference, the justice of which was corroborated by experimental tests, that the heat must be derived, not from any external source, but from some process at work in the radium itself. What this must be can perhaps be most readily understood by tracing the history of the investigations. In the year 1900, Crookes proved that ordinary uranium, instead of being, as had hitherto been supposed, a single metal was a mixture of which true uranium was the main component, but that the other—only a very small residue after the uranium had been separated—possessed radio-active properties to a far greater extent than the uranium itself. This residual substance, called at first uranium X, which had been precipitated together with a barium sulphate, had the familiar effect upon photographic plates, which the pure uranium had ceased to exhibit, though it retained certain electrical effects which were not produced by the other. But it was observed that the two substances, after they had been laid aside for about a year, had undergone a remarkable change.

[1] It consists mainly of two oxides of uranium with small quantities of the oxides of other (some of them rare) elements.

[2] De Tunzelmann, *ut supra*, pp. 330, 350 *et seq.*

The radio-activity of the barium compound, containing uranium X, had disappeared, while " that of the uranium had been completely recovered." Obviously, then, some striking transformation must have taken place in each substance, and it was inferred that uranium X was continuously produced by some process of disintegration from the uranium itself. This product it is, or at any rate one constituent in the uranium X, which after long efforts was isolated by Mme. Curie and received the name of radium. Further study proved that this substance is in a constant state of disintegration by a process of successively throwing off constituents which leave behind at each stage a residue also different from the original mineral. These stages of descent and their products have been carefully studied by the Curies, Rutherford, W. Ramsay, Soddy, Whetham, Boltwood, and others, with the result that the stages of transformation in the descent of uranium have been ascertained and may be briefly stated in the following sequence :—

Uranium, Uranium X, Ionium, Radium, Radium emanation, followed by six stages in the alteration of Radium (each with its own properties and duration of life) and ending with Polonium. Thorium and Actinium go through similar changes, and it has been more recently inferred that as bismuth, barium and lead very frequently are associates with uranium, some or all of them may be among its disintegration products.

Thus radium, to fix our attention on this very rare but singularly active and most remarkable element, may be said to be constantly dying, or, if the phrase be preferred, passing through phases of metamorphism ; giving up in the process that potential energy which was employed

in maintaining each one of these in succession. For the very existence of matter, as we shall presently see, depends upon a localization of energy. Without this there would be neither nebula, nor 'star-dust,' nor planet, nor suns; nothing but the ether of space at the absolute zero of temperature.[1]

One other most important discovery in regard to the transformation of elements must not be forgotten. In 1878, Sir N. Lockyer observed in the spectrum of the solar chromosphere a yellow line close to, but not coincident with, the group of lines indicative of the familiar mineral sodium, which did not correspond with any other known element, and was accordingly named helium by himself and the late Sir E. Frankland. In 1895, Sir W. Ramsay, on examining clevite, an uranium mineral, observed a line which, with the aid of Sir W. Crookes, he identified with that of helium, thus proving the latter to be a terrestrial substance. It has since been extracted from other minerals which contain compounds of uranium, thorium, yttrium and other scarce elements, besides being present in the gas evolved from the Bath springs and in certain rare earths. Sir J. Dewar, by making use of liquid air, succeeded in distilling it from the Bath spring gas, and it was found to be like those other very rare and inert gases—argon, neon, krypton and xenon.[2] Then, in

[1] The absolute zero of temperature, which may be presumed to prevail in parts of space, where ether has not yet granulated into matter, is inferred to correspond with 273 degrees below the zero of centigrade. Sir James Dewar, in his experiments on the liquefaction of gases, has been able to obtain a temperature only about 4 degrees above this minimum.

[2] Argon was discovered in 1895 by Lord Rayleigh and Sir W. Ramsay as the result of investigation, at first independent and

1903, Sir W. Ramsay and Mr. F. Soddy on examining the emanations from a small quantity of radium bromide, which had been kept for a long time in a solid state, discovered helium to be present among them and further investigation proved conclusively that helium was developed by a spontaneous change in the radium emanation, and in 1908, Sir J. Dewar, communicated to the British Association the results of a series of experiments which showed that "helium is continually produced from radium at the rate of 0·37 milligramme a day from a gramme of radium." [1]

These results, though others pointing in the same direction might be mentioned, may suffice to show that while the systems of corpuscles or electrons—in other words, the atoms of ordinary chemistry—are in general so stable as to be persistent under all ordinary circumstances, there are some—generally rare—which are exceptions to the rule: that these changes may be going on to a greater extent than has hitherto been supposed, and that they may have been more frequent and general under the conditions which prevailed in the early history of our globe, for the present one is only a late stage in a process of becoming, illustrations of which are given by the solar system to which it belongs, and by the luminous bodies which stud the vast expanse of space.

We are thus brought to the electron as the unit of matter —one of those infinitesimal bricks of which this is con-

then conjoint, and the other three by the latter and Dr M. W. Travers.

[1] De Tunzelmann, *Ut supra*, p. 334. A millegramme is one-thousandth part of a gramme. So 100,000 parts of radium daily produce 37 parts of helium: from which the 'life' of the former can be easily ascertained.

structed by the great Artificer. It is conceivable, and some of the authorities quoted above have suggested the circumstances under which such an event could occur, that the whole fabric of the universe might vanish, leaving "not a wrack behind" except ether and the electrons. But what is the relation of these electrons to ether and in what respect do they differ from it?

The concept of an ether, as a homogeneous 'something' filling all space, however empty this may seem, goes back to Greek and possibly ancient Indian philosophy, but Huygens (1629–1695) suggested that it existed as a frictionless or perfect fluid. Fresnel, however, (1788–1827) put forward the hypothesis of an elastic solid ether. McCullagh, in 1839, showed that it must have the same density everywhere but that its rigidity within material bodies must vary according to the nature of each of them, that it must offer resistance to any twist, but not to the passage of a material body which did not produce any such effect. Within the next half century great advances were made by Clerk Maxwell, Fitzgerald, Kelvin, and others, so that physicists in general came to think it highly probable that the molecules of matter were structures in the ether and had been formed from it. Lord Kelvin, for instance, suggested that matter might have a relation to the ether similar to that of a vortex ring (such as those which can be produced in smoking a pipe) to the air, but this conception, though satisfying many requirements of the problem, was less successful with others.

The concept of the electron, as a common ground between those of ether, electricity and matter, avoids the difficulties involved in the concepts of earlier date, so that

matter is now regarded as "a structure built up in and from the ether," in which each of the ultimate units cannot be separated from a charge of electricity. To this result another line of investigation converged. Soon after the middle of the last century Clerk Maxwell pointed out that certain laws of electricity, which not long before had been enunciated by Faraday, seemed to indicate that it must have a molecular nature. Helmholtz, at a later date (in 1881),came to the conclusion that positive and negative electricity must be divisible into definite elementary portions which behaved like atoms of electricity; or, in other words, he put forward an atomic theory for electricity as well as chemistry, though in a simpler form, and it was suggested by Johnstone Stoney that this natural electrical unit should be called an electron. Crookes, as a result of his experiments on the passage of electricity through 'vacuum tubes,' had already expressed a belief in the existence of a 'fourth state' of matter; Lorentz first published a definite electron theory and Zeeman calculated the ratio of the charge of an electron to its mass, but the subject was carried much farther by J. J. Thomson, who demonstrated by a series of elaborate experiments and calculations that the mass of one of these electrons must be only about, $\frac{1}{1700}$th of the mass of an atom of hydrogen (the smallest then known as capable of existence), and J. Larmor was the first to suggest the definite conception of an electron as a strain form in the ether. Thus a material unit, such as an electron, is now regarded, and with the best of reasons, as "only a peculiarity or singularity of some kind in the ether itself, which is of perfectly uniform density everywhere. What we 'sense' as matter is an aggregate or grouping of an enormous num-

ber of such units," [1] and this peculiarity or singularity appears to be a localization of strains at "an enormous number of positions in the ether itself." Thus, in the mind of the modern physicist, the material universe and everything in it, not excepting our own bodies, can be traced back ultimately to ether and electricity or some special form of strain, that is, to ether and an operation of energy. This conclusion has more than realized that vision of the ancient seer, which declares that at the beginning of the manifestations of creative power "the earth was without form and void . . . and the Spirit of God moved on the face of the waters."

It remains then to ask what is this energy which is more than the mainspring of the universe? To that question no complete answer can be given. It must be, like the ether, a fundamental conception; something, the attributes and operations of which we can describe, but which in itself we must postulate. It is, however, generally defined as the power of doing work, but that obviously is the statement of an attribute rather than a real definition of the entity. The concept of something of this kind dates from a very early period, for it may be reached by the way of abstract as well as of experimental philosophy. But the definite enunciation and development of the doctrine is one of the attainments of the nineteenth century. Without entering into details, many of which would be incomprehensible to the great majority of readers, it may suffice to say that this century witnessed the establishment, mainly through Lord Kelvin's researches in thermodynamics, of the principle of the conservation of energy, viz., that the amount of it in the

[1] O. Lodge, *The Ether of Space* (1909), p. 87.

universe, as known to us, is a fixed amount, which is incapable of being increased by any means with which science can deal, nor can it be diminished.

"The unaccounted-for appearance or disappearance of a quantity of energy in any process, however complex, would rouse as much scientific interest as the mysterious appearance or disappearance of matter. When it appears it must come from somewhere, and when it disappears it must go somewhere." [1] But it may seem to do the latter, that is it may assume a form whence it cannot be restored to its original condition without bringing other energy to aid in the process. This was originally called the dissipation of energy, but the phrase degradation of energy is now preferred, as less likely to suggest the erroneous idea of the actual loss of some portion of the energy. What has really happened is that it has assumed a form in which it cannot be so readily made useful; it has been locked up like capital—to use a rough illustration—in securities, which at any rate for a time, are inconvertible. It may be worth while to remark that this points to a fulfilling of the poet's words,

> "All earthly shapes shall melt in gloom,
> The sun itself shall die,"

and that this may ultimately be the fate not only of our solar system, but also of every other that may exist, unless there be (as is quite possible, in the apparently boundless æons of the future), some new localizations of energy in the vast spaces now occupied by nothing but the homogeneous ether. But these remote possibilities need not be discussed. It is enough to know that elec-

[1] F. Soddy, *ut supra*, p. 19.

tricity and even matter are the product of this energy, or power of doing work, or in other words of that which is 'at the back' of all the phenomena in our environment.

Science accordingly has led us retrospectively from a simplicity which is only apparent, through a complexity of a certain kind, to a simplicity which is real, and it confronts us at last with a dualism, which, however, is not Manichean, namely a material differing from all our notions of matter—invisible, impalpable, neither gaseous, nor fluid, nor solid in the ordinary sense of the term—and a Power, by which all things known to us have been called into existence, and by which they 'have their being.'

But the results which are due to this Power suggest that the word by itself is inadequate as a designation. Science discloses, as it penetrates farther and farther into the mystery of the universe, a 'reign of law.' While it discredits thaumaturgic aspects and brings order into the sphere of the miraculous (a subject to which we must again refer), it makes this law unintelligible except it be associated with a prescient Purpose, which we can only designate as Mind, and compels us to assume the existence of that which we connote by the term God. "Nature and man, science and history, present to us a host of problems which crave an answer from every thoughtful mind. 'Whence comest thou, whither goest thou?' may be asked of everything, of every personality which confronts us. We stand, as it were, in the presence of some vast machine, marvellous in its complication, wondrous in the beauty of its products. Yet is this all? Is there no meaning in this kaleidoscopic alternation of birth and death, no bourne to which they tend, no Heart

to which we may be the hands, but only an omnipotent energy, without conscious purpose, without all-perfect love ? "[1] Atheism, which is one solution of this problem, repudiates, in the words of F. Harrison,[2] " the theological doctrine of a Creator, and a Moral Providence. It admits no other existence than matter and force, and of these it offers no explanation. They are, and that suffices." But this solution need hardly be discussed, for the majority of thoughtful men will acquiesce in Comte's opinion that " atheism is the most irrational form of metaphysics, because it propounds as the solution of an insoluble enigma the hypothesis least capable of proof, least simple, and least plausible." [3] Even if they cannot accept the solution which has satisfied the Christian, they will admit, to quote the words of a well-known leader of their school,[4] " One truth must grow ever clearer—the truth that there is an Inscrutable Existence everywhere manifested, to which he [man] can neither find nor conceive either beginning or end. Amid the mysteries, which become the more mysterious the more they are thought about, there will remain the one absolute certainty, that he is ever in presence of an Infinite and Eternal Energy from which all things proceed."

The views of thoughtful men in regard to Christianity may be, and may have been for several years past, in a state of flux, but there can be no doubt that, with the majority of them, mere atheism has lost support. They shrink from definite statements on theological questions ;

[1] The author, *Old Truths in Modern Lights* (1891), p. 15.
[2] In *Fortnightly Review*, vol. xiv., p. 145.
[3] *Idem.*, p. 146.
[4] Herbert Spencer, *Ecclesiastical Institutions*, § 660.

they would not enlist in any theological battalion ; but even such an agnosticism as the admission that there is a supreme Power and Intelligence, coupled with the qualification that ' we do not know and cannot know anything about It,' would count fewer adherents than it did a quarter of a century ago. A bald and blatant atheism does unfortunately find more favour with the quarter-educated crowd, who suppose that Haeckel has solved the ' Riddle of the Universe,' and fail to detect that, notwithstanding his wide knowledge of and valuable researches in biology, he not seldom quietly begs a question and makes a postulate of that which requires to be proved. Lest I should seem to follow his too frequent example I will conclude this chapter by quoting the opinion of men well qualified to judge. Sir O. Lodge [1] remarks that it is impossible for a physicist to discuss, within the terms of courtesy, the physical hypothesis which forms the basis of this work (*The Riddle of the Universe*). Haeckel is by no means tender to opponents, for he puts them out of court by virtually declaring them to be victims of senility. Yet he quietly states, in the twelfth chapter of the book just named, that the principle of the conservation of energy ' is a necessary consequence of the principle of causality,' a statement which " in addition to being a philosophical absurdity, proves conclusively that he has never grasped the elementary fact that all physical science rests upon the foundations of observation and experiment." [2]

Neither does the new Œdipus who claims to have solved the Riddle find much favour from one of the most eminent of physiologists, Du Bois Reymond. He describes

[1] See De Tunzelmann, *God and the Universe* (1912), p. 14.
[2] *Idem*, p. 28.

Haeckel's genealogy of man, where to make the family tree complete the latter has inserted imaginary types (without any indication of their purely hypothetical characters), " which no observer has ever seen either in living or fossil form," as having " about as much value as the genealogy of Homer's heroes to a critical historian." [1]

If any farther indication be needed of what is thought by one of the most eminent living leaders in physical science, as to the origin of the universe, we may quote the words with which Sir J. J. Thomson ended his Presidential Address to the British Association at Winnipeg, " As we conquer peak after peak we see in front of us regions full of interest and beauty, but we do not see our goal, we do not see the horizon ; in the distance tower still higher peaks, which will yield to those who ascend them still wider prospects, and deepen the feeling, whose truth is emphasized by every advance in science, that ' Great are the Works of the Lord.' " [2]

[1] Quoted by De Tunzelmann, *Electrical Theory and the Problem of the Universe*, p. 493. Chapter xxiv., in which the passage occurs is most valuable, and the author gives a special criticism of the *Riddle of the Universe* in Appendix Q (p. 617).

[2] *British Association Report*, 1909, p. 29.

CHAPTER II

THE POSITION OF BIOLOGY

THE year 1859 will ever be memorable in the annals of Biological science, for it witnessed the publication of *The Origin of Species* by Charles Darwin. That book incorporated the fruits of laborious research and careful reasoning: it placed the hypothesis of evolution on a scientific basis, and showed it to be supported by a large number of ascertained facts. Prior to it, "ideas of evolution," as Professor Judd has remarked,[1] "both in the organic and the inorganic world, existed, but remained barren for thousands of years. Yet by the labours of a band of workers in the last century these ideas, which were but the dreams of poets and the guesses of philosophers, came to be the accepted creed of working naturalists, while they have profoundly affected thought and language in every branch of human enterprise."

The great body of naturalists, anterior to Darwin, had maintained the independent origin of species. Many of them were prepared to admit a considerable amount of variation, but all supposed that a certain

[1] *The Coming of Evolution* by J. W. Judd, C.B., in *Cambridge Manuals of Science and Literature* (1910), page 4, a small book which tells this interesting story no less succinctly than attractively.

number of forms of creatures now living were separately called into existence—created—at the beginning of the present phase of the world's history. A century or more ago the number of species of plants and animals which were known to science was much less than it is at the present time,[1] so that even the preservation of the latter from the Noachian deluge did not present any serious difficulty; indeed, a Professor of Divinity at Cambridge, some forty years ago, is said to have calculated the cubic capacity of the Ark, and demonstrated that it was able to house the animals which, as was supposed, were then in existence. As, however, their number increased, so did this difficulty, and attempts were made to overcome it by supposing the Flood to have been partial, not universal, and thus to have allowed of insulated 'camps of refuge.' But when this defence was more narrowly scrutinized it was found to be inefficient. The distribution of animals with limited powers of locomotion became inexplicable unless we assumed very marked changes in physical geography to have occurred since the waters began to cover the face of the earth. Supposing some mountain in Armenia ever to have been a centre of distribution for mammals, reptiles and terrestrial molluscs, how can we explain the existence of zoological provinces and the peopling of great insulated masses of land, like Australia and some of the more important Pacific and

[1] The number of species of animals was estimated in 1909 at about 790,000 (Wallace, *The World of Life*, p. 92), but any estimate must be very rough. By one authority the mammals are put (in 1881) at 2,300: by another, 28 years later, at 9,955: the birds also vary from 11,000 at the one time to 13,835 at the other.

Atlantic islands. Between them lie, in the words of Homer, "Many a shaded mountain and a roaring sea." But while scientific men allowed the Noachian deluge to drop, they still clung to the idea of a periodical destruction and reconstruction, whereby the living denizens of the earth were brought into closer and closer resemblance to its present occupants. For it was still maintained, and the view was far the more popular even so late as the middle of the last century, that there had been "successive destructions of the face of the earth, followed by the creation of new stocks of plants and animals."

As to the process of creation, opinions varied. One group, probably the majority, regarded it as some mode of rapid becoming, like that when, at the sound of magic music, "Ilion like a mist rose into towers." [1] God spake and they were created. But the ideas of others were much cruder; they understood in its most literal sense the story of the creation of man: "The Lord God formed man of the dust of the ground and breathed into his nostrils the breath of life," [2] extending their application to all other creatures. With the less educated indeed, a legend in the Apocryphal Gospels might have served to express such notions as they entertained. "In the sight of all Jesus took clay from the pools which he had made, and of it made twelve sparrows. . . . He struck his hands together, and said to His sparrows: Fly! And at the voice of His command they began to fly. And in the sight and hearing of all that stood by, He said to the birds: Go and fly through the earth, and through all the world, and live." [3]

[1] Tennyson, *Tithonus*. [2] Genesis ii. 7.

[3] *The Gospel of Pseudo-Matthew*, ch. xxvii. Ante-Nicene Christian Library, vol. xvi. (1870).

But though these crude ideas were being gradually dissipated, the majority of naturalists, at the end of the sixth decade of the nineteenth century, still adhered to the doctrine of the special creation of species, even when they were dropping or had abandoned that of their catastrophic destruction. But their position was being slowly undermined by the advance of geology. To speak only of our own country, that patient worker, William Smith, had turned to the best account his professional journeys as a land-surveyor, and had published in the year 1815 a geological map in which he demonstrated that a general order of succession was exhibited by the stratified rocks of England from the carboniferous system upwards. In a few years, Smith's scheme was elaborated by Conybeare and Phillips (1822), and somewhat later Delabeche, Fitton, and Lyell carried the work still further, especially among the newer rocks; while in the fourth decade the first-named began to extend the arrangement in the south-west of England downwards from the carboniferous rocks. Almost simultaneously Roderick Murchison, once an officer in the army, and Adam Sedgwick, Professor of Geology at Cambridge, grappled with the yet heavier task of introducing order into the masses of 'transitional rocks' which formed the mountains of Wales and the adjacent borderland of England. They were in the main successful,[1] and by 1838, when Charles Lyell first published his *Elements of Geology*, as a separate volume,

[1] It is needless to dwell on the difference, which afterwards led to an estrangement, about the arrangement of the lower groups of strata. Murchison's *Silurian System* was published in 1838. Sedgwick's results (including the geology of the Lake District) were communicated to various Societies from 1832 onwards.

it had become possible to give a good general account of English stratigraphy, as determined by the succession and fossil contents of the several beds. Knowledge rapidly increased as the workers multiplied during the next twenty years, so that in Britain, and in no small part of the Continent of Europe the work that remained by the end of this time was mainly the filling in of details and the enlargement of the areas of investigation, while no inconsiderable knowledge had been gained about other parts of the world. Thus Darwin had at his command, for the purposes of his work, a body of facts, the want of which would have made that work almost impossible for his predecessors, and he was prepared to make use of these, far better than they, by the extensive knowledge which he had acquired, both of geology and zoology, during his long voyage as naturalist on board the *Beagle* from 1831 to 1836. The immediate results of this—his observations and the impressions which they produced on his mind—were published in 1839, and afterwards took a separate form in that charming work *A Naturalist's Voyage: Journal of Researches into the Natural History and Geology of the Countries visited during the Voyage of H.M.S. 'Beagle' round the World.* "As Darwin, with the specimens before him, revised his notes, and reconsidered the impressions made on his mind, the 'vague doubts'[1] he had entertained from time to time concerning the immutability of species would come back to him with new force and cumulative effect. 'I then saw,' he says, 'how many facts indicated the common descent of species,' and further, 'It occurred to me in 1837, that something might perhaps be made

[1] See J. W. Judd, *ut supra*, p. 103.

out on this question by patiently accumulating and reflecting on all sorts of facts which could possibly have any bearing on it.' In July of that year he opened his first note book on the subject."[1] Before long the idea of evolution took possession of his mind,[2] and a study of Malthus' work on Population not only had the effect of removing some serious difficulties of which he had been conscious, but also suggested that 'natural selection' was the main factor in producing its results by eliminating those forms of life which were least fitted to hold their own in the 'struggle for existence.'

The birth, however, of Darwin's great work, *The Origin of Species*, was accelerated by a curious coincidence. In 1848 Alfred Russel Wallace, after spending four years on a collecting tour in South America, set off on a similar errand to the Malay Archipelago. The idea of evolution had already arisen in his mind, and was so strengthened by his researches in the latter region that he sent to the *Annals and Magazine of Natural History* a paper 'On the Law which has regulated the Introduction of New Species,' in which he expressed the opinion that "Every species has come into existence coincident both in space and time with a pre-existing closely allied species." As he remarked at a later date, in referring to the subject: "This clearly pointed to some kind of evolution . . . but the 'how' was still a secret." This paper was published in September, 1855, and at once attracted Darwin's attention, who

[1] J. W. Judd, *ut supra*, p. 106.

[2] The story of his careful and cautious work is told by Professor Judd, and will be found at greater length in *Life and Letters of Charles Darwin*, vol. ii. (1887).

began a correspondence with the author, without, however, giving him any hint of the theory of natural selection on which he had been silently pondering for some seventeen years.

" In the spring of 1858 Wallace was at Ternate in the island of Celebes, where he lay sick with fever, and as his thoughts wandered to the ever present problem of species, there suddenly recurred to his memory the writings of Malthus which he had read twelve years before. Then and there ' in a sudden flash of insight ' the idea of natural selection presented itself to his mind, and after a few hours' thought the chief points were written down, and within a week the matter was ' copied on thin letter-paper ' and sent to Darwin by the next post," with a letter asking him to show the document to Lyell, who had taken much interest in Wallace's former paper. The essay, in Professor Judd's words,[1] " is a singularly lucid and striking presentment, in a small compass, of the theory of Natural Selection."

The receipt of this document placed Darwin in a great difficulty. He had begun in 1856, at Lyell's urgent request, to write out the views at which he had arrived on the origin of species, and had completed two or three chapters. Besides this, he had written out, so long ago as 1842, a sketch[2] of his ideas about this subject, which had been copied and enlarged two years afterwards, the result being, in the words of a letter to Lyell :[3]

[1] *Ut supra*, p. 112.

[2] This first sketch was supposed to have been lost ; but it was found in 1896, after the death of Mrs. Darwin, when the house at Down was emptied, and was published by his son, Mr. (now Sir) Francis Darwin.

[3] *Life and Letters of C. Darwin*, vol. ii., p. 116.

"I never saw a more striking coincidence; if Wallace had my MS. sketch written out in 1842, he could not have made a better short abstract. Even his terms now stand as heads of my chapters"; and again, a week later;[1] "there is nothing in Wallace's sketch, which is not written out much fuller in my sketch, copied out in 1844 and read by Hooker some dozen years ago. About a year ago I sent a short sketch, of which I have a copy, of my views (owing to correspondence on several points) to Asa Gray, so that I could most truly say and prove that I take nothing from Wallace. I should be extremely glad now to publish a sketch of my general views in about a dozen pages or so; but I cannot persuade myself that I can do so honourably. Wallace says nothing about publication, and I enclose his letter. But as I had not intended to publish any sketch, can I do so honourably, because Wallace has sent me an outline of his doctrine? I would far rather burn my whole book than that he or any other man should think that I had behaved in a paltry spirit." He placed himself in the hands of Lyell and Hooker,[2] the two friends with whom he had been for years past in constant communication on the subject of his work. By their advice he wrote out a sketch of his own views, and sent it, together with the document received from Wallace, to the Linnean Society, at a meeting of which both were read (on the evening of July 1). This perhaps is rather a digression, but the incident and all their subsequent intercourse were so honourable to both men that they should never

[1] *Id.*, p. 117. The letters are dated June 18 and June 25, 1858.

[2] Afterwards Sir Joseph Dalton Hooker, O.M., G.C.S.I., C.B., who passed away December 10, 1911, in his ninety-fifth year.

be forgotten. It would almost certainly have estranged, or even converted into bitter enemies, fellow-workers of less noble disposition. With them it rather cemented friendship, and repeatedly in later life each expressed the heartiest admiration for the other.

Darwin then devoted himself, so far as his weak health allowed, to producing a book, shorter than that originally contemplated, and at the end of November, 1859, *The Origin of Species* made its appearance. How it was received will be described in a later chapter, but a short account of what the author sought to prove may be given here in order that the reader may more easily understand the present position of the theory of evolution. In the opening chapter Darwin gives instances to show that, by the intervention of man, great diversity may be introduced among the descendants from a common stock. For example, the domestic pigeons—carriers, fantails, pouters, tumblers, etc.—all trace their pedigree to the rock-dove (*Columba livia*) once common on certain parts of our coast. Careful breeding, continued for many years, has produced these diversities. The same holds good with other domestic birds and quadrupeds, and is now even more familiar to florists than it was when Darwin wrote. In the concluding chapter, after conducting his reader step by step through group after group of carefully marshalled facts, each viewed in the light of inductive reasoning, he sums up the results in the following sentences: "New species have come on the stage slowly and at successive intervals; and the amount of change after equal intervals of time, is widely different in different groups. The extinction of species and of whole groups of species, which has played so con-

spicuous a part in the history of the organic world, almost inevitably follows on the principle of natural selection : for old forms will be supplanted by new and improved forms. Neither single species nor groups of species reappear when the chain of ordinary generation has once been broken. . . . The fact of the fossil remains of each formation being in some degree intermediate in character between the fossils in the formations above and below, is simply explained by their intermediate position in the chain of descent . . . As the groups which have descended from an ancient progenitor have generally diverged in character, the progenitor with its early descendants will often be intermediate in character in comparison with its later descendants ; and thus we can see why the more ancient a fossil is, the oftener it stands in some degree intermediate between existing and allied groups. . . . Looking to geographical distribution, if we admit that there has been during the long course of ages much migration from one part of the world to another, owing to former climatal and geographical changes and to the many occasional and unknown means of dispersal, then we can understand, on the theory of descent with modification, most of the great leading facts in Distribution. We can see why there should be so striking a parallelism in the distribution of organic beings throughout space, and in their geological succession throughout time ; for in both cases the beings have been connected by the bond of ordinary generation, and the means of modification have been the same. . . . Although two areas may present the same physical conditions of life, we need feel no surprise at their inhabitants being widely different, if they have been for a long period completely

separated from each other. . . . On the view of migration, with subsequent modification, we can see why oceanic islands should be inhabited by few species, but of these, that many should be peculiar. We can clearly see why those animals which cannot cross wide spaces of ocean, as frogs and terrestrial mammals, should not inhabit oceanic islands : and why, on the other hand, new and peculiar species of bats, which can traverse the ocean, should be so often found on islands far distant from any continent. . . . It may be asked how far I extend the doctrine of the modification of species. . . . Fossil remains sometimes tend to fill up very wide intervals between existing orders. Organs in a rudimentary condition plainly show that an early progenitor had the organ in a fully developed state ; and this in some instances necessarily implies an enormous amount of modification in the descendants. Throughout whole classes various structures are formed on the same pattern, and at an embryonic age the species closely resemble each other. Therefore, I cannot doubt that the theory of descent with modification embraces all the members of the same class. I believe that animals have descended from at most only four or five progenitors, and plants from an equal or lesser number " ;[1] adding shortly afterwards that he would " infer from analogy that probably all the organic beings which have ever lived on this earth have descended from some one primordial form into which life was first breathed."

Evolution, it must be remembered, is, strictly speaking, a name for a process, and by natural selection Darwin meant the means by which this process is set in operation.

[1] *On the Origin of Species*, pp. 475–484.

The idea may be illustrated, though imperfectly, from another branch of science. Let the life history of an individual be represented by the motion of a particle. That particle, in accordance with Newton's second law, will continue in motion, uniformly and in a straight line, unless acted upon by an external force. If, then, the conditions under which the individual is living are and have for some time been constant, he should be merely a repetition of his progenitor, and his offspring would also be a repetition supposing the maternal parent to be identical in everything but sex with the paternal. But a change in the environment acts like an external force on the particle. In the latter its movement is deflected; in the living creature some change must result in the organism, and these changes will in many cases be cumulative. As they cannot be rapid, it may happen that, among the members of a variously modified group of living creatures, some may be less in harmony than others with a rather rapidly altering environment, and may suffer in consequence, so that they will not thrive so well as the more plastic members—may dwindle, deteriorate, and ultimately disappear from the face of the earth. There are other ways in which natural selection may operate to bring about the survival of the fittest. But Darwin showed (slowly and reluctantly as this was admitted) that as a process evolution was a fact, and that natural selection was an instrument of great importance in bringing it to pass. The question, however, remained open whether it was the only instrument, and concerning this, almost simultaneously with the dying down of the more noisy outcry against his hypothesis, some interesting and important controversies

began. It was felt that, while the evidence in favour of the existing species of animals and plants having arisen from older forms by a process of evolution was of most ample and convincing kind, the theory of organic evolution was incomplete " until we have arrived at a true account of the method or methods by which new species arise from old ones." [1]

The great naturalist Lamarck (1744–1829), perhaps the most eminent among the forerunners of Darwin, put forward the view (first published in 1801) that, as the organs of men and other animals are increased and strengthened by use, and particularly by conscious use, " this effect could be passed on by inheritance from parent to offspring, and so accumulated from generation to generation. In the case of animals Lamarck conceived the production of a new specific form to take place in the following way: Owing to some change of external conditions, the desire to perform some new kind of action was set up in the parent species, and by the hereditary effect of the striving occasioned by this desire a modification of the organs affected into forms, better fitted to carry out the new function, was gradually achieved. . . . In the case of plants, in which conscious effort is precluded, a similar result was supposed to have been attained by an hereditary accumulation of the effects of the environment." [2] Darwin's view differed from Lamarck's in this respect, that the offspring was seldom, or never, an exact reproduction of the parent, so that there was always more or less individual fluctuation in

[1] R. H. Lock. *Recent Progress in the Study of Variation, Heredity, and Evolution* (1906), p. 33.

[2] R. H. Lock, *ut supra*, p. 16.

each member of a stock, which enabled natural selection to come into play. His view had at least this advantage, that it required no conscious effort to produce a change, and was thus applicable to plants and the lowest forms of animals with no less ease than to the highest.

The general principle, however, of the survival of the fittest, as Mr. Lock remarks,[1] is quite untouched by modern criticism, but there are several points in regard to the amount of fitness required for survival, the rate of change and the transmission of acquired qualities, which are still under discussion. One difficulty, in regard to the application of Darwin's theory, lies in that of determining how far any peculiarity in structure is really beneficial to a plant or an animal. That they frequently are is unquestionable, as, for instance, in the modifications which have adapted an animal or plant to a particular mode of life, or have produced what are called protective resemblances, but in neither case can we be sure that this explanation covers the whole field. In regard to adaptation, as W. Bateson has remarked, we are confronted by "the logical difficulty that we can never make any quantitative estimate of the amount of benefit or the reverse which any particular structure may afford to its possessor. It is easy enough to imagine particular circumstances in which an organism developed in a particular way may be of undoubted service, but whether the net amount of such service throughout the life of the creature considered is greater or less than the strain upon its resources caused by the development of such an organ is quite beyond our powers of determination. The students of adaptation forget that even

[1] *Ut supra*, p. 45.

on the strictest application of the theory of selection it is unnecessary to suppose that every part an animal has, and everything which it does, is useful and for its good. We, animals, live not only by virtue of, but also in spite of, what we are. It is obvious from inspection that any instinct or organ *may* be of use ; the real question we have to consider is *how much* use it is. To know that the presence of a certain organ *may* lead to the preservation of a race is useless if we cannot tell how much preservation it can effect, how many individuals it can save that would otherwise be lost ; unless we know also the degree to which its presence is harmful ; unless, in fact, we know how its presence affects the profit and loss account of the organism." [1] In the matter also of protective resemblances, while their beneficial effects to the creature possessing them is obvious in many cases, there are resemblances the use of which is anything but apparent, such as those " between the shoots of *Casuarina indica* and those of the common horsetail, between *Saxifraga hypnoides* and certain mosses, between the horse- and Spanish-chestnut, between the seed of a pine and the fruit of an ash-tree. . . . It is impossible to believe that in such cases the resemblance itself is of any value to either species, and few people will be found to maintain that the likeness of the bee- or spider-orchis to an insect is of any utility to either animal or plant." [2]

Advances in Biology during the last half century have brought out more clearly two points ; one, that the

[1] W. Bateson, *Materials for the Study of Variation*, p. 12. Also R. H. Lock, *ut supra*, pp. 46–55.

[2] R. H. Lock, *Id.*, p. 53.

variations of the individuals in a line of descent are not always uniformly continuous ; the other, that there is some evidence in favour of the hypothesis that characteristics acquired by an individual from external influences can be transmitted to its offspring. This latter had great weight with Herbert Spencer, who had become convinced of the truth of evolution before the publication of the Origin of Species, for we find in one of his books this definite statement : " Close contemplation of the facts impresses me more strongly than ever with the two alternatives—either there has been inheritance of acquired characters, or there has been no evolution." [1]

A brief sketch of the history of these questions may enable us better to understand what is the present position of the endeavour to ascertain the cause of evolution. That the germ cells, transmitted from parent to offspring, have unique characters, is generally admitted, but to what are these characters due ? Spencer, in 1864, suggested the existence of physiological units, derived from and capable of development into cells, and supposed their accumulations in the reproductive elements. Darwin himself, in 1868, put forward ' a provisional hypothesis of pangenesis,' according to which (*a*) every cell of the body, not too highly differentiated, throws off characteristic gemmules, which (*b*) multiply by fission, retaining their peculiarities, and (*c*) become specially concentrated in the reproductive elements, where (*d*) in development they grow into cells like those from which they were originally given off. Stated in this form, the

[1] *The Inadequacy of Natural Selection*, p. 29. See for the substance of the following paragraphs *Chambers' Encyclopædia*, art. " Heredity."

hypothesis did not give general satisfaction; by some biologists it was repudiated, by others it was greatly modified. But the fact of a continuity could not be denied, and an explanation of it remained to be sought. A. Weismann (of Freiburg) put forward the following:[1] "(1) A small portion of the effective substance of the fertilized egg-cell remains unchanged during the development, and serves as a foundation from which the germ-cells of the new organism are produced. (2) This important substance—the 'germ-plasma'—which keeps up continuity from one generation to another, is part of the nucleus, possesses an exceedingly complex minute structure, but has, nevertheless, great stability, for it absorbs nourishment, and grows enormously without the least change in its molecular constitution. (3) But while part of this special nuclear substance or germ-plasma of the egg-cell is reserved unchanged for the formation of the germ-cells of the resulting organism, part of it is changed into the nuclei of the ordinary body-cells, where, however, it sometimes retains enough of its original efficiency to be able to repair serious injuries or start the development of a new organism in *asexual* reproduction." Satisfactory as this explanation appears to be in some respects, it must be admitted that "there is much that is entirely hypothetical about the 'germ-plasma' and its history."

Very important contributions to the discussion were made by Mendel and De Vries, the former having priority in research and publication by a few years, though the

[1] In Essays beginning in 1868, the first group of which was translated by R. Meldola, *Studies in the Theories of Descent* (1882); the second *Essays upon Heredity, etc.*, vol. i. (1889), vol. ii. (1892).

latter's work and conclusions were quite independent, because those of his predecessor had failed to attract the notice of his contemporaries. Mendel made the bulk of his experiments with sweet peas, or at any rate published only the results of these. Unfortunately for both his reputation and the progress of science, he published the results of his investigations in the comparatively obscure Transactions of the Brunn Natural History Society in 1866. He was an inmate of an Augustinian monastery, a teacher of natural science in the Realschule of that town, and was made in 1868 abbot of his religious house, not long after which he seems to have desisted from his researches.[1] His conclusions are thus stated: [2] "The male and female germ-cells of hybrid plants contain each of them one or the other member only of any pair of differentiating characters, exhibited by the parents, and each member of such a pair of characters is represented in an equal number of germ-cells of both sexes. Furthermore, separate pairs of differentiating characters conform to this law in complete independence of one another." Thus hybrid forms, unless self-fertilized, do not as a rule breed true.

De Vries repeated (without being aware of it) Mendel's experiments, though with other plants, and came to conclusions, which may be summed up as follows: "Broadly speaking, species arise by mutation, by a sudden step in which either a single character, or a whole set of characters together, become changed." This mutation may be of more than one kind. (1) An entire new character, or set of characters, may make their appearance; this he terms 'progressive mutation'; (2) when a charac-

[1] He was born in 1822. [2] R. H. Lock, *ut supra*, p. 180.

ter, partially latent, becomes active (that is, when a character, previously but rarely exhibited, is of frequent occurrence), or when the change is the other way; the one mutation is termed 'digressive,' the other 'retrogressive'—a type of mutation frequent among cultivated plants. Or there may be a throw back to some previous ancestor; such a mutation is termed 'atavistic.' Finally, new and distinct types may arise by the intercrossing of separate species, but De Vries does not regard this as an important source of permanent new forms. He also believed that, in one case, he had observed the formation of a new species, which had departed from a kind of evening-primrose, *Œnothera Lamarkiana*, an American plant.[1] Certain of these had "escaped from a garden and were running wild over a potato field near a town called Hilversum in Holland. On examining these plants, De Vries found two distinct new forms, which were quite unlike the remainder," and of these he could find neither specimens in the great herbaria nor mention in botanical literature. Each "occurred in an isolated patch, as if it had arisen from the seed of a single plant." He took seed from some of these, sowed it in his garden, and found that the new forms came true to type. He carried his experiments farther, and ascertained that of about 50,000 individuals, which were grown to a recognizable stage, more than 800 showed mutation; that is, differed specifically from the parent *O. Lamarkiana*, and these belonged to about fifteen kinds, most of which appeared repeatedly, though some were more frequent than others. His estimates of the number of the plants exhibiting variation, were necessarily rather

[1] R. H. Lock, *ut supra*, p. 135.

rough, in consequence of the large number of specimens which sometimes, owing to want of sufficient and ample space, were an incumbrance to the investigation, but he thought that if he put those exhibiting mutation at 1½ per cent., he would be understating rather than overstating the amount.

Of late years these experiments have been repeated and many of a like kind undertaken in different countries, notably by W. Bateson and R. C. Punnett of Cambridge who have made use of Andalusian fowls for the purpose. The general result has been to confirm De Vries' results, and it shows, as stated by Bateson in his *Materials for the Study of Variation*,[1] that differences of the kind which are generally used to distinguish separate species may arise as single (i.e., discontinuous) variations; (2) that such forms of variations are by no means so uncommon a phenomenon as was formerly supposed; (3) and that variations of this kind may occur in every description of organ and part in a number of different plants and animals. He, with others, has also shown that variations, large in amount, are produced by hybridization, or in other words, that new species are more likely to arise from this process. Apparently, it is also proved that, instead of hybrids mingling the characters of father and mother, they really have in a simple form the character of each, so that in the cross breeding of a number of hybrids certain characters may become intensified and combined so as to produce a novel form.

We seem then justified in concluding that evolution, as opposed to what is commonly called the creation of species, may now be regarded an established theory, not

[1] Published in 1894. See R. H. Lock, *ut supra*, p. 121.

an hypothesis on probation, without, however, excluding the possibility of some future modification in the form of statement.

For instance it may be possible that, as there are laws of definite combination among the atoms and molecules of chemistry, so something of this kind may hold good among the germ-cells, or in the special constituents of these, which determine the character of the offspring: in other words that variation may be possible, not in an unlimited but in a restricted number of directions. This, however, time will show; it will not affect the general truth of the law. But in regard to the mode or means which bring about this ordered variation or evolution, we cannot yet speak so positively. We think also that natural selection, as asserted by Darwin, Wallace and others, is undeniably a most important factor; for without it how are the forms less adapted to wage the struggle for existence (which will generally be those intermediate and vague in character) to be removed, and the distinction of varieties, species, and the like, to be made more definite? Granted, however, that there is in any stock an innate tendency to variation, if we may so call it, because the offspring is not really a simple copy of its parent or parents (in the latter case there would be *ipso facto* no variation), how far can impressions from without, as results of environment, be transmitted from a parent to its offspring? For the occurrence of this, in the case of a mutilation, or anything of that nature, there does not seem to be any evidence, but though some of the statements may have been exaggerated which were formerly brought forward to show that characters acquired by parents (*e.g.*, from marked changes in their

habits of life) were transmitted, we do not seem to be in a position altogether to deny its occurrence, though it is not, apparently, a factor of such importance as was formerly supposed. In fact, some time must elapse before a question, so much more difficult than that concerning the fact of evolution, can be settled, and this is no wonder—because the earlier stages of the process of change (in the germinal cells) and the factors which produce them cannot be watched or seen even with the best microscopes. It is also possible that in trying to discover the exact rule which governs the formation of a new species we are doing something very like seeking a single solution for an indeterminate equation ; just as that admits of more than one, so the distinctive characters of the species may be the outcome of a group of influence variable in character which may co-operate in different degrees. This may be among the questions which it is hardly possible for investigators to see from all points of view simultaneously, and in a case where each of the observers is obliged to look at a few facets only of a gem, which, like one of the old Indian diamonds, has been cut with little regard to symmetry, their impressions may differ in some not unimportant respects.

When the *Origin of Species* was first published the evidence in favour of evolution, derived from the past history of the earth, though strong in some cases, was defective in others. This, Darwin frankly acknowledged, but attributed it to the imperfection of the Geological Record. That might be said to resemble a seriously damaged copy of a ' Family Tree ' ; here the writing was obliterated ; there the document itself was tattered. But there were hopes, nay more than hopes, as he declared,

of filling up—it might be from better preserved copies in other lands—some of its gaps. That has been done to an extent to satisfy the expectations even of the most sanguine. The general succession of life has been much more completely traced than it was half a century ago, and in some cases where certain special forms of animals, in rocks well adapted for examination and in which fossils are well preserved, have been studied by experts, they have succeeded not only in determining the actual position of each one in the volume of the earth's life history, but also in tracing the gradual transition from one species to another.[1] Some of the evidence—and that among the most important, for it would throw so much light on the early stages in the history of evolution—can never be recovered, because the most rudimentary forms of life have a structure so little differentiated as to be unprovided with solid parts, and thus incapable of preservation,[2] but the beginnings of life have now been carried further back in time than when Darwin wrote, while the discovery of new forms and the filling up of structural and other gaps between those already known, has been very great. How the matter now stands may perhaps be more easily understood if

[1] For instance, in the case of a particular sea-urchin (*Micraster*) in the upper part of the Chalk, by Dr. A. W. Rowe (*Quart. Jour. Geol. Soc.*, vol. lv. (1899), p. 494.

[2] To this statement there are certain remarkable exceptions. Some of the Protozoa—*Foraminifera* and *Radiolaria*—secrete mineral tests which, though very small, are of considerable intricacy and beauty, but these creatures are not at the very bottom of the 'Family Tree.' Casts also of jelly-fish (*Medusa*) are said to have been identified in some ancient rocks, but even they, although unprovided with hard parts, possess an integument and exhibit considerable differentiation of structure.

we give a short statement of what has been deciphered from the record of the rocks. In 1859 the history of the Cambrian Fauna was so incomplete that Darwin writes : [1] [The objector] " may ask, where are the remains of those infinitely numerous organisms which must have existed long before the first bed of the Silurian system was deposited : I can answer this latter question only hypothetically, by saying that, as far as we can see, where our oceans now extend they have for an enormous period extended, and where our oscillating continents now stand they have stood ever since the Silurian epoch ; [2] but that long before that period, the world may have presented a wholly different aspect ; and that the older continents, formed of formations older than any known to us, may now all be in a metamorphosed condition, or may lie buried under the ocean."

Few geologists would now refuse to admit (what most of them would have disputed in 1859) that, underneath the base of the Cambrian system, as at present defined, a great group of rocks exists, many of which have once been ordinary sediments, but have been now so altered by metamorphism (the combined action, in variable proportion, of heat, pressure, and water) that any traces of organisms, if ever present in them, must have been obliterated. But in the upper part of this great series of rocks, called Archæan, are practically unaltered sediments, and

[1] *Origin of Species*, p. 343. It is, however, probable that Darwin uses the term Silurian, as it was employed by Murchison, to include (quite unjustifiably) almost the whole of the Cambrian : still, even if that were so, not a few fossils have been discovered since 1854 (the date of Siluria) in what he must have allowed to be outside the limits which he had accepted for the Silurian.

[2] Probably, if he had been writing now, he would have, to some extent, qualified these statements.

in these fossils have been detected. They are not at present numerous, are often ill-preserved, and thus difficult to determine, but they certainly represent creatures low down in the scale of organization. We may therefore infer that many of those which lived at that time were incapable of leaving any traces of their existence, but notwithstanding this we may expect that before men celebrate the centenary of the *Origin of Species*, the Pre-Cambrian fauna will have been considerably augmented. At present, in the lowest beds of the Cambrian system, in North America more numerously than in Britain and the rest of Europe, we find a fair number of genera and species. In regard to this, it may suffice to quote the words of the most recently published of the advanced text-books of geology [1]: "The most remarkable feature of the Cambrian fauna is its complexity. Although it is the earliest known to science, it is by no means primitive in constitution. It includes a number of highly specialized forms, the evolution of which from any primordial germ of life must have required many ages to complete. Moreover, it contains representatives of all the *phyla*, or main branches of the animal kingdom, excepting only the vertebrata. Even at this early date the broad lines on which evolution was to proceed were already settled. It is apparent, therefore, that the Cambrian fauna can scarcely represent the advent of life on the globe. . . . Both in abundance and in stratigraphical importance the brachiopods and trilobites stand in the first rank." [2]

[1] P. Lake and R. H. Rastall, *A Text-Book of Geology* (1910), p. 304.

[2] The former, which have bivalve shells, are by some grouped with the *Mollusca*; by others (and now more often) with the

The number and variety of fossil forms are much increased in the next great group of rocks—now generally called the Ordovician—in which the trilobites attain their maximum of genera and species ; the brachiopods become very numerous ; the graptolites—representatives of the Hydrozoa, with some relationship to the sea-firs (*Sertularia*) common on our shores—are often abundant; certain forerunners of the crinoids or " sea-lilies " and *Polyzoa* (*Molluscoidea*) are more sparingly found, and it may be remarked that both here and in the Cambrian some organisms have been found, the classification of which presents many difficulties, often because of their rather rudimentary structure and their resemblance to the members of more than one of the great divisions now recognized. In the Silurian system " the fauna is similar to that of the Ordovician though many of the genera and most of the species are distinct " ; the majority of the more important groups are better represented, though one or two are obviously dwindling, such as the trilobites and graptolites. But the earliest British sea-urchins and star-fishes appear in the uppermost part of the Silurian, and, high up in that, the first known remains of fishes. Representatives of these become quite numerous in the Devonian, the next system, and plants, which hitherto have been rare and rather obscure are now comparatively common. They mostly represent the ferns and lycopods (club-mosses). In the Carboniferous system, the lower part of which is generally marine and the upper freshwater in origin, at

preceding class, the *Molluscoidea ;* the latter with the *Crustacea*. They have a general resemblance to the familiar wood-louse, but the upper part of the integument exhibited three lobes, from which they have been named

any rate in Britain, plants become abundant, for coal is formed from their remains. They chiefly belong to the two orders already named and to that which includes the horse-tails (*Equisetum*), but some conifers are also found. The fauna is allied, though with some important modifications, to that of the preceding system, but now the trilobites follow the graptolites which had all but disappeared when it began. There is, however, one important accession, for, at a comparatively early time, the first representatives of the amphibians make their appearance. The Permian system follows, and concludes the first great volume, as we may call it, of the earth's life history; the chief point in its fauna, which calls for special notice, is the occurrence of the first reptile.

We may pass rather more rapidly over the second volume in that history, because, as it probably does not cover nearly so long a period—perhaps not more than a quarter—as the preceding one, the changes recorded in it, though far from inconsiderable, are very conspicuous only in one great division of the animal kingdom—the vertebrates. Hitherto fishes only have been really well represented, and even with these the dominant forms are such as have now almost disappeared from the earth; the amphibians, however, seem to be rather more numerous, and in some cases are interesting, but the great advance is with the reptiles, which show a remarkable increase in number, size and variety, so that this great Secondary era (to use a common name for it) is often called the "Age of Reptiles." In Britain the Trias, which is the first chapter in the volume, has not retained many relics of these creatures, probably because it was deposited under rather exceptional conditions, namely, in

a land of deserts traversed by great rivers. But they are more abundant in some parts of Europe, and in strata of approximately the same age in South Africa, where some peculiar forms existed, one of which suggests that it might have succeeded in tracing back its pedigree to the amphibians. The reptiles, however, become both conspicuous and abundant in the next chapter of the history, called the Jurassic, and continue through the third one (which some geologists prefer to divide into two). During these periods reptiles tenanted both sea and land; in the former, they were sometimes bigger than the largest sharks, and as their jaws were armed with not less formidable teeth, they must, like them, have been terrors to the fish; in the latter they seem to have preferred the neighbourhood of water. Many of them attained a large size. In shape they varied much and were often strange, the more peculiar forms occurring more often in Western North America than in Europe. All, of course, were quadrupedal, but some of them appear to have been built on the pattern of a kangaroo, and when sitting up their noses must have been quite sixteen feet from the ground. Of this curious type one was a vegetarian, the other carnivorous. Some wore defensive armour, such as *Stegosaurus*, which had a row of great triangular plates, running down its back from neck to tail, and *Triceratops*, with its huge skull extending backwards, like a cape to the neck, and adorned with horns, frontal and nasal; making its head so heavy that it may very well have 'died of over-specialization.' Others again attained a gigantic size, such as the *Diplodocus*, of which we can see a model of the skeleton (the gift of Mr. Carnegie) in the British Museum. It had a small head, a long neck

and a longer tail, measuring about eighty feet from end to end, and was probably amphibious, since its shape is ill adapted for ordinary progress on land, and its teeth show by their shape that they are too slender to have dealt with any thing tougher or harder than succulent vegetation. But the " dragons in their prime " were not restricted to the land and the water, they could also fly. Their wings, however, did not resemble anatomically those of a bird, and were not provided with feathers, but were formed by a modification of the finger-bones, especially the first one, which were united by a membrane, so as to have more resemblance to the flying apparatus of a bat. From this feature they are called Pterodactyles. The head was large and the jaws were armed with rather long pointed teeth, so they were probably the cormorants of the sea. In size they differed much; some being small, no larger than a woodcock or a gull, but in other cases the spread of the wings attained, if it did not exceed, sixteen feet.

Another group of reptiles that haunted the sea in the later part of the Secondary era—the one during which the chalk was deposited in Britain and some of the adjacent parts of Europe—anticipated the sea-serpent, of which we hear mariners' tales from time to time. These attained a large size, for some which have been discovered must have been forty or fifty feet in length. The animal resembled a snake in general form, but it was furnished with rather small paddles, and its great jaws were armed with formidable pointed teeth. As the first noteworthy specimen was discovered near Maestricht the creature has been named *Mosasaurus*.

In considering the Age of Reptiles, as has been well

remarked,[1] "We cannot but marvel greatly at the diversity of forms assumed by the various orders of this class; their strange uncouth appearance, their assumption, in some cases, of characters only known at the present day among the mammals, their great abundance, and the perfect state in which their remains have been preserved in the stratified rocks of various parts of the world. And the reader may naturally ask, 'How is it that so many types have disappeared altogether, leaving us out of a total of at least nine orders, only four, viz., those represented by crocodiles, lizards, snakes and turtles?' To such a question we can only answer that the causes of the extinction of plants and animals in the past are not yet known. Climate, geographical conditions, food-supply, competition, with other causes, doubtless opertated then as now; but if there is one clear lesson taugh by the record of the rocks, it is this—that there has been at work from the earliest periods a Law of Progress, so that higher types, coming in at certain stages, have ousted the lower types, sometimes only partially, sometimes completely. . . . In the great onward and upward struggle for existence, higher types have supplanted lower ones; and in accordance with this biological truth, we find that in the next era (known as the Tertiary, or Cainozoic) the mammal held the field while the reptile took a subordinate place."

But before coming to the former we must briefly notice the birds, because, though they have never attained such a size as some members of each of the other two classes,

[1] By H. N. Hutchinson, *Extinct Monsters* (1910), p. 197. A book which gives, so far as possible without technicalities, descriptions of these strange creatures of other days, with good illustrations to show their probable aspect.

they also tender interesting evidence in regard to evolution. Birds do not appear very early in the geological record, though some of the reptiles—especially the great order of the *Dinosauria*—exhibit certain avian tendencies, i.e., structures suggestive of an effort to put forth a branch in that direction. It is not till we come to the upper part of the Jurassic system that we meet with a creature which can claim to be recognized as a bird, and even this may be said to occupy an intermediate position between that class and the reptiles. It had feathers and claws, as a bird has, but its jaws were furnished with teeth ; its vertebræ were biconcave, like those of fishes and some extinct saurians, and its backbone, as in a lizard, ended in a rather long tail, to each joint of which a pair of feathers was attached. This remarkable instance of a form, which united the characters of two classes now so well distinguished, does not appear to have been a success, for, so far as we at present know, its remains are very rare, and they have been discovered in only a single formation and district.[1] In Cretaceous times birds appear to have been commoner and more closely related to existing forms, but some at any rate of them had their bills armed with teeth, and these appendages were occasionally retained in the earlier part of the Tertiary era. The remains, however, of birds, probably owing to their habits of life, are less common than those of either reptiles or mammals.

The history of the latter is interesting and also supplies

[1] Two or three specimens only of the *Archæopteryx*, which was about as big as a rook, have been found, and that in the so-called ' Solenhofen slate ' of Bavaria (a stone used in lithography), which corresponds in age with the lower part of the Kimeridge Clay (Upper Jurassic) of England.

evidence in favour of evolution. When mammals first made their appearance is a little uncertain. In the upper part of the Trias, both in Britain and in America, a very few teeth and lower jaws have been discovered which are considered to have belonged to mammals of rudimentary organization, like the Monotremes and Marsupials [1] of the present day. Nothing more is found till rather before the middle of the Jurassic, where in the Stonesfield "slate" and the Purbeck beds of this country, the remains of several Marsupials have occurred. In the Upper Jurassic of America, chiefly in Wyoming, and in strata about the same age as those which have yielded one of the hugest Dinosaurs, the remains of mammals are more numerous. Professor O. C. Marsh, in 1887, stated [2] that the remains which had been discovered represented upwards of two hundred distinct individuals. He divides them into fourteen genera, containing altogether twenty-five species, and groups them in two orders, from one of which, in his opinion, the 'modern, specialized Insectivores' (shrews, hedgehogs and moles) were derived; the others being probably the ancestors of the Marsupials. He also remarks that "the modern Placental mammals were evidently not derived from Marsupials, as is generally supposed. Each group has apparently come down to the present time, by separate lines, from primitive oviparous forms, of which the living Monotremes may be the more direct but specialized representatives."

[1] To the Monotremes belong the *Duck-billed Platypus* (*Ornithorhynchus*) and the Spiny Ant-eaters (*Echidna*). Both resemble birds in laying eggs and discharging the waste products of the digestive system through one outlet. To the Marsupials, also Australasian (mostly) but more numerous, belong the kangaroos, opossums, wombats, etc.

[2] O. C. Marsh, *Geological Magazine* (1887), pp. 241, 289.

Thus representatives of the mammals probably have existed from very early in the Secondary era, but throughout its long ages they were ' feeble folk,' small in size and low in organization. Perhaps the physical conditions of the countries which up to this time have been investigated, were unfavourable to them ; perhaps, and this seems very probable, there was not room in the world for them and the great terrestrial reptiles, by whom they were ' sair hadden doun,' since, as must have happened if evolution be right, they had got the start in the race. Certain it is, that, as the late Professor Gaudry remarked, the mammals did not begin to be ' en pleine évolution ' till the Tertiary era. With the end of the Secondary, the great reptiles, whether on the land or in the sea, rather rapidly disappear, and are replaced, with seeming rapidity, by large, though hardly so gigantic, mammals. The latter also are at first rather generalized in character and differ from those which are at present in existence, much more widely than the molluscs or other invertebrates.

" The transition times were doubtless of long duration and full of stirring events ; but their archives for the most part have either been destroyed, or have yet to be discovered. The results, however, of what then took place are plain enough. There had been a great elimination of old forms of reptile and other life. . . . Dinosaurs, herbivorous and carnivorous, had one and all vanished from the scene—iguanodonts with their spiked thumbs, stegosaurs with their battlemented backs, and the rest of the fraternity. Old Triceratops with his thrice-horned head and Elizabethan frill seems to have held out as long as any, but fortune failed him at last. In short, the old reptile nobility, unable to march with

the times, had been swept away. Nor had ichthyosaurs, plesiosaurs, and flying lizards fared any better. They had all quitted the stage never to return. Mammal life, now triumphant, was represented by forms far surpassing in variety and importance the primitive creatures known in earlier times. . . . The animals had not become so far differentiated as to make them closely comparable with any members of the existing mammal orders. But intermixed as they were in affinities, they exhibited some notable differences. It is clear, therefore, that some important divergencies had taken place before the 'new dawn.'" [1] One of the earliest, both in date and discovery, lived both in Europe and in North America. It was first found in 1846, when a fragment of a jaw was dredged up from the sea-bed between Harwich and St. Osyth, from which Sir R. Owen rightly inferred the creature's zoological position. Afterwards a tooth was found, 160 feet below the surface, at Camberwell, which showed that the animal to which it had belonged was living when the Woolwich and Reading Beds (the lowest but one in the Eocene system) were deposited. It was then found at more than one locality in the North of France and afterwards more abundantly in Wyoming and New Mexico. *Coryphodon*, as it was called, apparently had a general resemblance to a tapir, some species being about that size, others as large as an ox. Still bigger and more remarkable were the representatives of the order *Dinocerata*, some of which were quite as large as the rhinoceros with the same heavy build. One form, *Dinoceras mirabile*, which roamed about the shores of a large lake that once existed in Wyoming, had no less than

[1] H. R. Knipe, *Evolution in the Past* (1912), p. 116.

six bony protuberances on its skull, which probably, like those on the giraffe, did not support horns. *Coryphodon* was a ' generalized type ' of mammal, that is, it presented " certain characters seen in several groups of living quadrupeds, and not any of those elaborated or highly developed parts which we see in such animals to-day, none of which appear to have descended directly from them." [1] In several cases, however, it is possible to trace the pedigree of some well known living quadrupeds back to ancestors in early Tertiary days, but we must be content, for want of space, to mention one or two instances, which may also serve to give an idea of the general course of mammalian evolution in Tertiary times. That of the horse is perhaps the more familiar, and has been the most completely worked out, so that now " hardly a single important gap is left between the original five-toed ancestor, and the horse of to-day with only one toe to each foot." The development appears to have taken place in Europe, and in North America, along separate and parallel lines, of which the latter, owing to the greater richness of materials, has been traced in the greater detail.

The pedigree begins with the little *Eohippus*, of the Eocene period, which had a wide range in both America and Europe. It was only eleven inches high at the withers, with a short head and hand, four little hoofs and part of a fifth, and in outline presented no great resemblance to a horse. Next comes *Hyracotherium*, which was about three inches taller and slightly more horse-like in shape, and had only four toes. Passing over an intermediate form we come to *Mesohippus*, rather larger and with only three toes, of which the middle one was distinctly the biggest,

[1] H. N. Hutchinson, *ut supra*, p. 255.

which lived about the middle of the Miocene ; then to the larger *Protohippus*, with a much enlarged central toe ; and after another living step comes *Hipparion* of the Pliocene, which was the size of a donkey, distinctly horse-like in general aspect, with one large central toe and the other two very much attenuated. This was succeeded, late in the Pliocene, by representatives of the true horse [1] (*Equus*).

During the last decade, the pedigree of the Elephant has been carried much farther back by the interesting researches of Dr. C. W. Andrews on remains obtained by himself and members of the Egyptian Geological Survey from the Fayum, where also specimens of a huge and strange creature have been found, which, though out of the direct line of descent, claims a passing notice. In general build it was something like a rhinoceros, and it bore above its eyes and nostrils two enormous horns, which must have almost attained a yard in length, and were very wide at the base. The affinities of this strange creature, called Arsinoitherium, from a Greek Queen of Egypt near to the site of whose palace its bones were found, are not easily determined. It has some to the *Dinoceras* and the Elephant, but may well be more nearly related to the living *Hyrax* or ' coney ' of Scripture. The elephant, however, has been traced by Dr. Andrews back to an ancestor of Middle Eocene times, which, as it haunted the district around the old Lake Mœris has been called *Mæritherium*. This was about as big as a tapir, with only incipient proboscis and tusks. Then came, still in the Eocene period,

[1] In this extra digits sometimes occur. A number of instances of the peculiarity were collected by Prof. Marsh, of which a summary is given by H. N. Hutchinson, *ut supra*, p. 247.

the *Palæomastodon*, yet more elephantine in aspect, but with rather short tusks. It had a moderately long proboscis which, however, could not have been very flexible for it was partly supported by an unusually elongated lower jaw. This was followed, in the Miocene, by *Tetrabelodon*, which had also an elongated lower jaw, but longer tusks, and few grinding teeth. This must have been very like an elephant, except for the first-named feature, and the next stage was the shortening of that jaw and the lengthening of the trunk and proboscis, till in the Mastodon and Elephant, both inhabiting the Old and the New World—the one from late Miocene, the other from Pliocene times, we come to numerous forms, of which at the present day, the only survivors are two of the latter genus.

Similar accounts might be given of the past history of many other groups—camels, giraffes, deer, carnivores, etc.—but this must suffice, and we must pass on to the question of man.

In *The Origin of Species* Darwin made no reference to man, probably thinking it wise to avoid so thorny a subject, though he can hardly have failed to have taken it into consideration. But the question was beginning to be stirred, though in an indirect manner, by a debate about the antiquity of the human race. So long ago as the opening of the last century Mr. John Frere gave a clear account to the Society of Antiquaries [1] of the discovery at Hoxne, in Suffolk, of rudely chipped flint weapons or implements under circumstances which pointed to their very great antiquity. His paper was published, but, strange though it may seem, attracted little notice and

[1] *Archæologia*, vol. xiii. p. 206.

was soon forgotten. Again, about 1833, Dr. Schmerling, of Liege, had explored some forty ossiferous caves in the valley of the Meuse and had found in them not only flint implements and cut bones but also portions of human skeletons, which were certainly very ancient. About the same date the Rev. Mr. MacEnery found in Kent's Hole, a cavern near Torquay, rude flint implements, together with bones of the mammoth, an extinct species of rhinoceros, the cave-bear and other mammals, in positions which also pointed to their great antiquity; but, as a number of untoward circumstances prevented the publication of his researches, that discovery also passed unnoticed. But in 1847, M. Boucher de Perthes, of Abbeville, published [1] an account of flint implements which, for the last six years, he had been collecting from gravels near that town. Their geological position showed that their antiquity must be very great. His statements at first were greeted with general incredulity, for which there was some excuse, since his enthusiasm had undoubtedly carried him too far in his identification of relics of the past, but they attracted the attention of other investigators, both in his own country and in England,[2] by whose aid the main fact that man must have existed, when the physical geography of the Somme Valley differed much from that of the present time, was placed beyond all

[1] *Antiquites Celtiques et Antédiluviennes.* A sketch of the early history of these discoveries is given by Sir J. Lubbock (Lord Avebury) in *Prehistoric Times*, p. 269 (1865).

[2] Dr. Rigollot, at first a sceptic, found them in considerable abundance at St. Acheul near Amiens, publishing an account of these discoveries in 1855, and the facts were confirmed by Dr. Falconer, followed by Joseph Prestwich and John Evans, all in 1858, and immediately afterwards by other competent investigators.

reasonable doubt. This was soon followed by the discovery of similar relics, including occasional bones of the makers, elsewhere in France, in Britain [1] and in other parts of the world, so that much has now been ascertained about the history of these Primitive Hunters,[2] During the last two or three decades Palæolithic Man, as the fabricators of these rudely-chipped instruments have been collectively named, is asserted not to have been the first of human kind. Certain fractured flints, which have been found in deposits of considerably greater antiquity, are claimed as indicative of human workmanship, but not a few students of this branch of archæology are still sceptical whether these 'eoliths,' as they are called, are formed by other than natural agencies, and they are still more sceptical as to the alleged proofs of the existence of man so far back as the middle of Pliocene times. But whether they are right or not, whether the appearance of man in Britain was subsequent or prior to the deposit of the Chalky Boulder Clay, whatever may turn out to be the anthropological position of the 'Heidelberg jaw' or the *Pithecanthropus* of Java,[3] there can be no doubt

[1] They had already been discovered, as stated above, but without attracting general notice, by Mr. Frere, at Hoxne (Suffolk), prior to 1800, and by the Rev. J. MacEnery at Kent's Hole (Torquay) between 1825 and 1829. A specimen, now in the British Museum, was found about the end of the seventeenth century in London, 'opposite to black Mary's near Grayes Inn Lane.'

[2] A book, with this title, by Prof. W. J. Sollas (the first edition of which was published in 1911), gives a most interesting account of the whole subject, and of other races which in quite recent times have represented similar phases of a rudimentary civilization.

[3] The one, found under circumstances suggesting a greater antiquity than the makers of the ordinary palæoliths, exhibits

that man must have been in existence for several thousands, perhaps even some millenniums of years. Sir C. Lyell, in his well known book, *The Antiquity of Man*, stated, in 1863, the evidence in favour of this, and Darwin, in 1873, wrote his *Descent of Man* to express his view that the human race could not be excluded from the general law of evolution and must be content to accept a simian ancestry.

We must now glance very briefly at the evidence afforded by the fossil remains of plant life. This is everywhere defective till we reach the Carboniferous system, when it becomes more ample. There the vegetation is locally abundant, but, as has been already remarked, it is of a rather low type. In the Permian period, however—the last chapter in the Palæozoic volume—the conifers gradually secured a better footing and towards its end the signs of coming change cannot be overlooked, the results of which are dominant until near the end of the Mesozoic era. Some of the new-comers present resemblances to spruces and sequoias ; some to yews and the gingko-tree (*Salisburia*) of China and Japan, but with the Trias the representatives of the club-mosses and horsetails show that those plants of low organization had become less important features in the landscape. The ferns continue to flourish and approximate more closely to living genera, two groups, which appear rather late in the period, being allied, one to the king-fern (*Osmunda*), and the other to the well known genus *Polypodium*. Cycads " were in evidence on various paths of develop-

a peculiarity of structure, which points to some simian affinity, while the scanty remains of the other (from strata supposed to be Pliocene) are said to indicate a creature which was either ' the most ape-like of men or the most man-like of apes.'

ment ; some seem to have been on the lines of the modern Zamia (*Zamites*), others on the lines of the Australian *Cycas*." [1] These attained to a higher degree of organization and approached more nearly to angiosperms, the most highly developed of living plants, and they apparently " held the leadership in the leafy world." Together with conifers and ferns, they flourished in the Jurassic period and were remarkable for their abundance and the extent of their range,[2] thus differing widely from their present restricted limits and impoverished condition.

" The sylvan scenes of the early Cretaceous presented for the most part much the same aspect as those of the Jurassic," [3] but a change was coming, and new forms, which had probably been shaping themselves in the more northern regions of America, began to spread southwards. " Here and there, south of Canada, growths leaved like fig-trees, willows, sassafras, and magnolia were reconnoitring ; and, as time went on, primitive forms of oaks, poplars birches, and other deciduous growths joined the movement." Subsequently this vegetation appeared in Europe and it had extended, before the end of the Cretaceous period, over this continent, so that the predominance of the dicotyledons, which is characteristic of the present vegetable kingdom, may be said to have been assured.

During the Tertiary era the changes were many, but such as are to be more especially attributed to the remarkable phases in climate which this era exhibited. The Eocene period was warmer than the Cretaceous and towards the middle of it the climate of the South of England must have been almost tropical. " Fan-palms and

[1] H. R. Knipe, *ut supra*, p. 71. [2] *Id.*, p. 88.
[3] *Id.*, pp. 112, 113.

feather-palms, screw-pines, eucalyptus, nettle, and spindle trees, and various kinds of climbing plants, now more or less confined to the tropics, adorned the scenes. Similar evidence is found in other parts of Europe; whilst in North America palms and bananas were thriving in latitudes which now are temperate." [1]

After this phase the climate gradually became colder, with corresponding changes in the vegetation, until, about the middle of the Pliocene period, it differed little from that which now prevails in corresponding parts of Britain. For the remainder of that period, the temperature became lower and lower, until at its end it brought about, apparently rather quickly, that strange phase to which the name of the Glacial Epoch has been given. At its coldest part the climatic conditions were not less severe in our own Islands than they now are in Spitzbergen, and its result was to spread a mantle of snow and ice over the more mountainous parts and to expel the plants, which were adapted to a temperate climate, forcing them to migrate southwards. A flora of an Arctic character then took possession of such parts as were not covered by snow-fields and glaciers, from which they had again to retire as the climate became more genial, ceding the field to a flora, which had hardly saved itself by its retreat to the south and partly had been developing in that region. These final changes left the northern invaders no other choice than to die from too much warmth or to seek camps of refuge among the higher hills.

Thus the past history of plant-life, though on the whole it is rather less complete, confirms that of animal life, and we can confidently affirm that the facts which have

[1] *Id.* p. 133.

been discovered since 1859 show that the gaps which then existed in the Geological Record have been largely filled up, and that evidence has been obtained which justifies the assertion that a process of evolution holds good in all parts of the earth, among all forms of life, both high and low, and throughout the whole course of terrestrial history.

We must now pass on to the question, which has often been a subject of discussion among scientific men and to which attention has again been called during the last few months, namely, the origin of life. Of life itself many definitions have been given, but the majority, if not all of them, prove, on investigation, to be more or less elaborate statements of the undeniable fact that 'life is life.'

As Professor Schäfer remarked in his Presidential Address to the British Association at Dundee,[1] "Everybody knows, or thinks he knows, what life is; at least, we are all acquainted with its ordinary, obvious manifestations. It would, therefore, seem that it should not be difficult to find an exact definition. The quest has nevertheless baffled the most acute thinkers. Herbert Spencer devoted two chapters of his *Principles of Biology* to the discussion of the attempts at definition which had up to that date been proposed, and himself suggested another. But at the end of it all he is constrained to admit that no expression had been found which would embrace all the known manifestations of animate, and at the same time exclude those of admittedly inanimate objects." The attempt to define may be doomed to failure, because, as

[1] Page 2 (in the separate form issued on Sept. 5). It has now appeared in the volume of the Report of the Association for 1912 (page 4).

some think, life differs essentially from the forces commonly called physical, being incapable of being produced by any synthesis of inanimate matter and its origin being a mystery, or, in other words, because it is necessary for us to settle, before seeking for an ideally perfect definition of life, whether those are right who uphold the aphorism, "Everything living comes from that which is alive," [1] or whether it may in some way or other take its origin from the interaction of inanimate material; that is to say, whether (to make use of technical terms) the verdict of science is to be in favour of biogenesis or abiogenesis. In olden time the latter view was more commonly accepted, at any rate among ordinary people. Ovid,[2] for instance, relates how Proteus was compelled to disclose to an old-time farmer, whose bees had perished, the way in which he might replenish his hives. 'Kill a bullock,' said he, 'and bury the carcase.' The advice was followed, and a new-born swarm promptly issued from the ground so that "one death gave birth to a thousand lives." [3] It was not till after the middle of the seventeenth century that the contrary view was maintained on scientific grounds. In 1660 Francesco Radi, an Italian, published a book entitled *Esperionza intorno alla Generazione degl' Insetti*. In this he described the results of a number of experiments which had convinced him that the apparent generation of living organisms in cases of putrefaction was merely due to the access of germs already present in the air. His views, summed up in the Latin aphorism already quoted, though attacked as contradictory to the

[1] *Omne vivum e vivo.* [2] *Fasti*, Book i., 379.

[3] . . . Fervent examina putri
De bove: mille animas una necata dedit.

generation of bees from the carcase of a lion, supposed to be asserted in the Book of Judges, were generally accepted, but after a time the improvements effected in microscopes stirred up some doubts whether the aphorism was applicable to the most minute and simple forms of life. But after a prolonged investigation two things became evident: one, that the complete destruction of germs was a more difficult matter than had been supposed ; the other that the same was true of efforts to prevent them from obtaining access to a mixture after it had been completely sterilized. In fact, the general position of scientific students, some half century ago, was very much that which Charles Kingsley intimated in *The Water Babies*, that spontaneous generation would always happen when the experimenter kept the voltaic battery dirty enough. Each assertion of an occurrence of abiogenesis led to a new series of experiments under more and more strict conditions, some of the severest tests being applied by Pasteur in France and Tyndall in England, both of whom were firmly convinced that the apparent spontaneous generation was only a result of imperfect exclusion of the outer and contaminated air. Abiogenesis, however, about forty years ago found a vigorous defender in Charlton Bastian, who maintained the old view and related the results of experiments which he regarded as demonstrating that not only could these extremely low types of organisms be produced in sterilized and thoroughly protected mixtures, but also animals considerably higher up in the scale of life. His opponents repeated their experiments with the same negative results, but Bastian remained unconvinced and returned to the charge in a book entitled *Studies in Heterogenesis* (1901), in which and other

publications he carries farther his original contention—that not only were the very low organisms spontaneously generated in sterilized and properly protected fluids, but also those of more complex structure, such as rotifers; and besides this he maintains that from a simpler form one more advanced was often produced, at a single step. He failed, however, to obtain much support from his fellow-workers in science, whose general position has been recently summarized by Dr. Chalmers Mitchell in the following passage,[1] which indicates that, while they have a clear conviction as to the results of experiments, they regard the question without prejudice. "It may be that in the progress of science it may yet be possible to construct living protoplasm from non-living material. The refutation of abiogenesis has no further bearing on this possibility than to make it probable that if protoplasm ultimately be formed in the laboratory, it will be by a series of stages, the earlier steps being the formation of some substance, or substances, now unknown, which are not protoplasm." And Huxley in his Presidential Address at Liverpool in 1870 says: "But though I cannot express this conviction" (i.e., of the impossibility of the occurrence of abiogenesis, as exemplified by the appearance of organisms in hermetically sealed flasks) "too strongly, I must carefully guard myself against the supposition that I intend to suggest that no such thing as abiogenesis ever has taken place in the past or ever will take place in the future. With organic chemistry, molecular physics and physiology yet in their infancy and every day making prodigious strides, I think it would be the height of presumption for any man to say that the conditions under

[1] *Encyclopædia Britannica*, Art. "Abiogenesis."

which matter assumes the properties which we call ' vital ' may not, some day, be artificially brought together." Professor Schäfer, who in his recent address expresses the opinion that life, instead of being the result of an act distinctly creative, is but a step in the process of evolution which is exhibited by the inorganic world, nevertheless, goes on to say, after expressing his disbelief in the experiments favourable to abiogenesis, to which we have already referred, " If spontaneous generation is possible, we cannot expect it to take the form of living beings, which show so marked a degree of differentiation, both structural and functional, as the organisms which are described as making their appearance in these experimental flasks. Nor should we expect the spontaneous generation of living substance of any kind to occur in a fluid the organic constituents of which have been so altered by heat that they can retain no sort of chemical resemblance to the organic constituents of living matter." [1]

At the same time he points out that much has been done, during recent years, to narrow the gap between the inorganic and the organic forms of matter. Many substances supposed to be peculiar to living organisms—indigo, madder, rubber, etc.—have been synthetically produced in the laboratory. Physicists have demonstrated that ' spontaneous ' movements, hitherto supposed to be characteristic of that which is alive, occur " in substances which no one by any stretch of imagination can regard as living ; movements of oildrops, of organic and inorganic mixtures, even of mercury globules, which are indistinguishable in their character from those of the living organisms we have been studying : movements which

[1] *British Association Report*, 1912, p. 12.

can only be described by the same term amœboid, yet obviously produced as the result of purely physical and chemical reactions causing changes in surface tension of the fluids under examination. It is therefore certain that such movements are not specifically 'vital,' that their presence does not necessarily denote 'life.'" [1]

Besides this, and other processes, one of which may be more conveniently noticed later, the chemistry of organic matter is now known to be not so entirely different from that of inorganic substances as was once believed. We are "no longer compelled to consider living substance as possessing infinite complexity." The elements composing it "are few in number. Those which are constantly present are carbon, hydrogen, oxygen, and nitrogen. With these, both in nuclear matter and also, but to a less degree, in the more diffuse living material which we know as protoplasm, phosphorus is always associated. 'Ohne Phosphor kein Gedank' is an accepted aphorism; 'Ohne Phosphor kein Leben' is equally true. Moreover, a large proportion, rarely less than 70 per cent., of water appears essential for any manifestation of life, although not in all cases necessary for its continuance, since organisms are known which will bear the loss of the greater part, if not the whole, of the water they contain without permanent impairment of their vitality. The presence of certain inorganic salts is no less essential, chief among these being chloride of sodium and salts of calcium, magnesium, potassium and iron. . . . The above considerations seem to point to the conclusion that the possibility of the production of life—i.e., of living material—is not so remote as has been generally assumed." [2]

[1] *Id.*, p. 6. [2] *Id.*, p. 11.

That the geological record should furnish any evidence in regard to the origin of life is not to be expected. As we have already stated, this record is most imperfect in the earliest stages of the history of creatures which have lived, and even if future discoveries carry this history back into ages of which at present we know nothing, it is practically impossible that the most primitive forms should leave any traces of their existence. The most rudimentary of those which now exist consist mainly of protoplasm, and exhibit only the slightest differentiation of structure—lumps or specks of living jelly, which after death will vanish like a morning mist, leaving 'not a wrack' behind, or even an impression on the mud which has entombed them. If the process is still continued, if the least and lowest forms of life, instead of having their origin at a very remote period, when this globe had cooled down from an incandescent state to a temperature which living tissues could endure, were the results of a synthetic process which is still at work, the task of detecting a body, so obscure in character and possibly so small in dimensions, would be one of the greatest difficulty. This, however, seems favourable to the former view, by accepting the other we are placed in the following dilemma. Extremely low forms of life are abundant at the present day. We must therefore admit, that they have either been recently brought into existence or have, in some way or other, been exempt from the influences of those impulses which have produced, in all past times, the evolution which has been already described—in other words, they have been stationary through countless millenniums. Corroborative evidence may also be obtained from a grade rather higher up in the scale

of progress. There are a number of creatures, known as *foraminifera* and *radiolaria*, which, though very rudimentary in their organization, can secrete tests or 'shells,' and these, though generally minute, exhibit both beauty of form and complexity of structure, especially among the *foraminifera*, some of which occasionally attain a fair size.[1] Both of these can be traced back rather far; one familiar form, *globigerina*, which is abundant not only in the chalk but also in the deep sea ooze in many parts of the ocean, goes back to the Trias, and the differences between the earlier and the later representatives are practically inappreciable. We must therefore infer, either that they have stood still, or that this phase of evolution is constantly being traversed by creatures on their ascent of the ladder of life.

It has often been contended "that growth and reproduction are properties possessed only by living bodies, and constitute a test by which we may differentiate between life and non-life, between the animate and the inanimate creation." Of this supposed test Professor Schäfer [2] goes so far as to say, "no contention can be more fallacious," proceeding to give his reasons for this assertion, some, at least, of which seem hardly to justify so strong a phrase. For instance, the following: "Inorganic crystals grow and multiply and reproduce their like, given a supply of the requisite pabulum.[3] In most cases for

[1] They are two of the orders in the class *Rhizopoda*, in the sub-kingdom *Protozoa*.

[2] *Ut supra*, p. 9.

[3] We find an anticipation of this statement in prescientific days and in yet more precise terms, for we are told in the *Travels of Sir John Mandeville*, ch. xvii., that in India diamonds "grow together, male and female. And they be nourished with the dew of heaven. And they engender commonly and bring forth small children that multiply and grow all the year!"

each kind of crystal, there is, as with living organisms, a limit of growth which is not exceeded, and further increase of the crystalline matter results not in further increase in size but in multiplication of similar crystals." Here much depends on the meaning which is attached to the word 'growth.' Crystals increase, when supplied with the requisite pabulum, but we think that in minerals it would be far more difficult to fix a standard of size than in living beings (if we confine our attention to any one particular kind). Some minerals—as, for example, the diamond—are, no doubt, generally rather small, but the discovery in January, 1905, of the 'Cullinan,' [1] in the Premier Mine, Transvaal, which weighed more than three times as much as the largest then known and was only a part, perhaps not one half, of the original crystal, shows how that rule may at any time be broken. Nor do we know valid reasons for supposing that the growth of a crystal is arrested when it reaches a certain size or by other causes than changes in the supply of pabulum and in its environment. The well-known minerals, apatite, beryl, quartz and some of the felspars, vary even more in size than the diamond. All of these may be found of microscopic size, yet crystals of apatite are often much over a foot in length; one from Buckingham (Ottawa county) in Canada weighing 550 pounds and measuring over 72 inches in circumference; the longest of a group of eight crystals of smoky quartz, found in a fissure of a cliff above the Tiefen Glacier in Canton Uri, Switzerland, measures 39·4 inches in length. So far as my own experience goes, and it is a fairly large one, I cannot say that I

[1] A description and illustrations of it are given in the *Geological Magazine*, 1905, p. 170. Its weight was 9600·5 grains.

have ever met with evidence suggestive of one crystal ceasing to grow after having reached a full stature and this arrest having been followed by a multiplication of similar crystals. Quartz, for instance, may, under some circumstances, develop itself in a number of crystals, all of a considerable, or of a moderate, or of quite a small size. It is a common thing to find a specimen where there are hundreds of crystals which are hardly visible to the unaided eyes, or tens of them which may be perhaps a third of an inch in diameter, and in which the prism supporting the pointed roof of the crystal may be, now not even that length, now an inch or two, yet all of them adopt the same habit. Other phenomena are exhibited by crystals, which seem to us physical rather than vital. The spine of a kind of sea-urchin, rather common in the chalk, by the addition of a little carbonate of lime, derived, no doubt, from the surrounding rock, while retaining perfectly its outward form may lose its characteristic internal structure, and exhibit that of crystalline calcite. The crystal of another mineral, while retaining its characteristic shape, and without any chemical change, so far as we can ascertain, may shift the position of its constituent molecules to such an extent as to assume the cleavage and physical characters of another mineral, usually regarded as quite distinct.[1] As, however, the two are chemically identical this may be attributed to dimorphism, i.e., the habit of some chemical substances to crystallize in such a way as to belong to different systems.[2]

[1] The one is called augite, the other hornblende.

[2] Diamond and graphite, than which it is difficult to find greater contrasts, are dimorphic forms of carbon; calcite and aragonite, of carbonate of lime; quartz, with the rarer forms tridymite and asmanite, of crystallized silica.

To this habit, where the same plasm, if the term be permitted, can assume at the outset either of two perfectly definite forms, it is difficult to find a parallel in the organic realm. If a phenomenon of 'growth, it is almost as if from one lot of spawn some should be Common and others Edible Frogs. Professor Schäfer, no doubt, can quote the authority [1] of one distinguished geologist in support of his claim for mineral vitality, but we doubt whether he is not to some extent availing himself of an almost inevitable ambiguity in a term and mistaking the analogous for the identical. He states also that, "the growth and division of artificial colloids of an inorganic nature, when placed in an appropriate medium, present singular resemblances to the phenomena of the growth and division of living organisms. Even so complex a phenomenon as the division of a cell nucleus . . . as a preliminary to the multiplication of the cell by division—a phenomenon which would *primâ facie* have seemed and has commonly been regarded as a distinctive manifestation of the life of the cell—can be imitated with solutions of a simple inorganic salt, such as chloride of sodium, containing a suspension of carbon particles; which arrange and rearrange themselves under the influence of the movements of the electrolytes in a manner indistinguishable from that adopted by the particles of chromatin in a dividing nucleus. And in the process of sexual reproduction, the researches of J. Loeb and others upon the ova of the sea-urchin have proved that we can no longer consider such an apparently vital phenomenon as the fertilization of the egg as being the result of living material, brought to

[1] See *Quarterly Journal of the Geological Society*, vol. xliii. (1887), p. 58, *et seq.* (Proceedings).

it by the spermatozoon, since it is possible to start the process of division of the ovum and the resulting formation of cells, and ultimately of all the tissues and organs—in short to bring about the development of the whole body—if a simple chemical reagent is substituted for the male element in the process of fertilization. Indeed, even a mechanical or electrical stimulus may suffice to start development."[1]

These facts are undoubtedly remarkable, but, in regard to the former group, since vital phenomena, to use the common phrase, are to a large extent the result of physical forces, may not the immediate cause of the transferences described above, when occurring in an organism, be an electrical current or something of that nature? The question really being whether these can be brought into action without the intervention of some form of life (the machine causing the movements in the solutions of salts is worked by a living operator)? The habits also of crystals suggest difficulties, for they show that in some cases their life is less than ephemeral (e.g., 'frost-flowers' on a window), while others, such as quartz in a granite, are veritable strulbrugs. If, however, these are said to have died when the rock first consolidated, then we must admit that their corpses do not return to the dust for an extraordinarily long time, unless they happen to be exposed to the action of some external force. But, in regard to the later group of the above-mentioned phenomena—the physical substitute in the case of reproduction—may they not be comparable with cases of parthenogenesis, as it is often called, where an unfertilized female becomes productive, a phenomenon which has been observed

[1] *British Association Report*, 1912, p. 9.

even in crustaceans and insects which belong to a higher sub-kingdom than the echinodermata? So far then as this evidence is concerned, it may be prudent to await the results of further investigations.

Let us, however, suppose it to be proved that the beginning of life is nothing more than a step in the great process of evolution, which we have admitted to be exhibited in all its subsequent developments, no less than it is in the physical world. This wider extension of 'the reign of law' does not make it easier for us to explain how that can exist apart from a Supreme Intelligence and Power, which we can only designate as a Lawgiver. Purpose and Design seem everywhere perceptible among living things; the most complicated results come from the most unpromising beginnings. In some mysterious way the most highly organized beings—man himself—potentially exist in a cell nearly without differentiation and of almost microscopic size. That cell, generally after impregnation, which imports another similarly minute factor, grows, steadily but rather rapidly, increases in complexity no less than in magnitude, builds up into its structure myriads of cells on a definite pattern, which seems as if preordained, until it arrives at its adult stage. That cell also will produce one definite result and none other, though for a time it will be impossible to determine, from an examination of the cell alone in its earlier stages of development, what that result will be. The oak, for instance, is latent in the germ of the acorn, and each kind of animal, from the almost shapeless protozoon to the most highly developed mammal, is similarly latent in its embryo—and the parent cell will produce in each case one particular organism and none other. No interference from any factor in

its environment, no treatment at the hands of man, can alter this result. These may maim or otherwise mar it, but the seed will produce the particular tree, the animal give birth to the particular offspring which is strictly representative of the parents' race.

The process of evolution is at work in the individual from its earliest to its latest stage, and seems also to bring about in it the reproduction, though in outline and in rapid succession, of the several steps by which its remote ancestors have ascended to the position now occupied by the race. In glancing back over the history of life, as deciphered by the palæontologist, we find that 'failures' are not nearly so numerous as we should reasonably expect them to be if the creatures, which now inhabit our globe, and their predecessors during the long ages of the past, had 'blundered' onwards till at last they had got into a tolerably right and satisfactory condition. It is quite true that some races have obviously succeeded better than others; some have been more numerous in individuals and species; some have occupied the stage for a much longer time; many races seem to have been better adapted to their environment than others; but even those which have dwindled or have disappeared, have done this in consequence of some change in that environment to which they were unable to adapt themselves. For Nature's rule, is that which William of Wykeham inscribed on the walls of his school at Winchester, '*Aut disce, aut discede, manet sors tertia cædi,*' and this may be thus rendered for our present purpose, 'Learn to adapt yourself to circumstances, or migrate to find those more suitable, or pay the penalty'—decadence and extinction. But, notwithstanding this, we can hardly venture to assert

that even the most restricted orders or genera have been real failures. They have done moderately well and have played a part, even if a small one, on this world's stage, for a time compared with which, in all probability, any human dynasty is short-lived. Natural selection, or whatever it be, that is at work in changing the actors in the more than millennial drama, has removed them, perhaps not less slowly than it introduced them. The rocks are not crowded, any more than the world is at the present day, with the remnants of the malformed and the unfit.

If then life had its beginning in some synthesis of inanimate matter, if it originated in a shapeless structureless lump of protoplasm or something even lower down than this in the scale of organization, what gave it, what continues to give it, that extraordinary capacity for self-development, self-construction, self-improvement? It was alone in a world otherwise lifeless, apparently destitute of anything in itself to formulate wants or desires, or to suggest the means of gratifying them, if they happened to arise, and of working for its own advantage. This jelly was 'alive' and had to obtain the means for the continuance of life—it could not remain unchanged and inactive, as a mineral might have done, and if a portion of it had contrived, somehow or other, to feed on the remainder, surely this self-cannibalism would have led to the fate of the proverbial Kilkenny cats? Something or other must have impelled these protoplasmic creatures to take one course and avoid another, have made them aware what 'to eat, drink, and avoid.' This formless jelly, though mouthless, stomachless, brainless, must have had, latent in itself, instinct, however rudimentary, by means of

which it was able to rise, however slowly and tentatively, above the stage which the mineral had reached without any further ascent, we know not how many millenniums before that fateful synthesis, in which life began.

We may be unable to agree with the teaching of the older school of teleologists, that the particular organs in this or that animal were made, as we now see them, in order to serve a special purpose, as the bill and tongue of the woodpecker, the peculiar forefinger of the aye-aye, the hooked-claw of the bat, and such like structures, but when we observe the way in which plants are in harmony with their surroundings and animals are found to possess structures which, though latent and invisible in their ancestry and at birthtime, are able to develop themselves, we cannot but feel that Paley's argument of the watch still retains much force.

The mineral differs from the animal in one respect which we cannot but think important ; it is without any capacity for modification or improvement. It is subject, as all know, to alteration ; some of its constituents may be removed, others may be added, by external agencies ; it may be broken up by pressure and the fragments may again be cemented, also by external agencies, but it is not thereby structurally improved or necessarily rendered more durable. When certain chemical elements combine to form a crystal, then no other mineral (except in cases of dimorphism) will ever be produced. From the earliest to the latest geological epoch which we are able to investigate, the minerals which have the same composition are at all times the same. If we compare the quartz, the felspar and the mica, in a granitoid rock of Archæan age with the corresponding minerals in the

newest rock of that kind, to which we can obtain access, we find them identical in chemical, optical and physical characters. No sign can be detected of any one of them having made the slightest advance beyond the stage which it occupied at the beginning of its existence, and that stage was assumed, at once, when the mineral was deposited from a state of solution either in water (probably hot) or in a molten magma. We must, I think, admit that the mineral either remains permanently in a state which, in the case of the animal, would be called protoplasmic—a state from which the living jelly has struggled upwards to man—or that it was born in its full development, like Pallas from the head of Zeus. Certainly, if life came from some special synthesis of the inanimate, it was a synthesis unique in character, which entailed the most far-reaching consequences and established a cleavage in the natural world—that between the living and the non-living—so marked as to be generally recognized.

We must be content only to refer to Bergson's [1] emphatic distinction between life and matter, because it would be impossible to give, in a short compass, his elaborate reasoning, and because he regards the subject rather from the point of view of a metaphysician than of a worker in the Natural Sciences, though evidently well acquainted with the advances which have been made in them. This extract may serve to express his view in regard to the living body: "It is composed of unlike parts that complete each other. It performs diverse functions that involve each other. It is an *individual*,

[1] Henri Bergson, *Creative Evolution* (Authorized Translation by Arthur Mitchell), 1911.

and of no other object, not even of the crystal, can this be said, for a crystal has neither diversity of parts nor diversity of functions. No doubt it is hard to decide, even in the organized world, what is individual and what is not. The difficulty is great, even in the animal kingdom; with plants it is almost insurmountable. This difficulty is, moreover, due to profound causes, on which we shall dwell later. We shall see that individuality admits of any number of degrees, and that it is not fully realized anywhere, even in man. But that is no reason for thinking it is not a characteristic property of life. The biologist who proceeds as a geometrician is too ready to take advantage here of our inability to give a precise and general definition of individuality. A perfect definition applies only to a *completed* reality; now vital properties are never entirely realized, though always on the way to become so: they are not so much *states* as *tendencies*. And a tendency achieves all that it aims at only if it is not thwarted by another tendency." [1]

But in his elaborate review of the present order of the world and of the universe, so far as it is known to us, and of the principal systems of philosophy which have attempted to explain this order and its relation to the unknown, Bergson regards it as inexplicable apart from God as the Power of which that order is the outcome, as, for instance in these words: "If the same kind of action is going on everywhere, whether it is that which is unmaking itself or whether it is that which is striving to remake itself, I simply express this probable similitude when I speak of a centre from which worlds shoot out like rockets in a fireworks display—provided, however,

[1] *Idem*, p. 13.

that I do not present this centre as a *thing*, but as a continuity of shooting out. God, thus defined, has nothing of the already made ; He is unceasing life, action, freedom. Creation, so conceived, is not a mystery ; we experience it in ourselves when we act freely. . . . In reality, life is a movement, materiality is the inverse movement ; and each of these two movements is simple, the matter which forms a world being an undivided flux, and undivided also the life that runs through it, cutting out in it living beings all along its track. Of these two currents the second runs counter to the first, but the first obtains, all the same, something from the second. There results between them a *modus vivendi*, which is organization." [1]

This might be claimed as simple Pantheism, which, however, does not follow from the general tenor of the book, though this position has been reached by many philosophers in both ancient and modern times. But among the advocates of Pantheism, which we must briefly notice, there are grades. One extreme, while they differ from theists as that title is commonly understood, and perhaps would refuse to import into their concept of the Divine any notions of a deliberate purpose, intent, or design, as it is commonly designated, regarding this as the outcome, in some sense the embodiment of the Power, in itself illimitable and undefinable, and while they would repudiate any such idea as a moral government of the world and a constant endeavour to " make for righteousness," would nevertheless maintain that God was everything. But the other extreme, of which Professor Haeckel is the advocate, and that with no uncertain voice, dismisses with scorn the idea

[1] *Idem*, pp. 262, 263.

that there are or can be " forces which can exist or operate without a material basis." The form of Pantheism, which apparently commends itself to him, regards God as " an intramundane being, everywhere identical with nature itself, and operative within the world as ' force ' or ' energy.' . . . It follows necessarily, therefore, that Pantheism is the world-system of the modern scientist," [1] and his meaning will be made clearer by a later passage. " Atheism affirms that there are no gods or goddesses, assuming that god means a personal extramundane entity. This ' godless world-system ' substantially agrees with the monism or pantheism of the modern scientist; it is only another expression for it, emphasizing its negative aspect, the non-existence of any supernatural deity. In this sense Schopenhauer justly remarks : ' Pantheism is only a polite form of atheism. The truth of pantheism lies in its destruction of the dualist antithesis of God and the world, in its recognition that the world exists in virtue of its own inherent forces. The maxim of the Pantheist God and the world are one is merely a polite way of giving the Lord God His *congé*.' "

Whether all Pantheists would accept this description of their views is perhaps open to doubt. Some, we think, would affirm that God was both intramundane and extramundane, and that the relations of the one phase and the other were in a way comparable with those of matter and ether. What the Pantheist would repudiate is any such dualism as that which found its fullest expression in the Manichæan phase of Oriental philosophy and which contrives, occasionally to secure a position,

[1] *The Riddle of the Universe* (translated by J. McCabe) 1906, pp. 102, 103.

but sometimes only to lurk, in the Christian religion. A Pantheism would be possible, to which we shall refer in a later chapter, which might regard everything as a manifestation of God—the bush at which Moses gazed on Horeb no less than the flame which left it unconsumed—and yet could believe that this God might love the world as, and because, it was a part of Himself. But the more general position was that of Epicurus and Lucretius, that, though the Deities had called the universe into being, they had then left it to its fate. For they lay reclined, like the Gods in the Lotos-eaters "beside their nectar careless of mankind," and the bolts are hurled—

> "Far below them in the valleys, and the clouds are lightly curl'd
> Round their golden houses, girdled with the gleaming world;
> Where they smile in secret, looking over wasted lands,
> Blight and famine, plague and earthquake, roaring deeps and fiery sands." [1]

This, of course, is not atheism, but so far as any practical results are likely to go, it is no great improvement on it. This, however, has not been the creed of the majority, at any rate since men began to liberate their minds from the lower forms of polytheism. They, by whatever course they may have arrived at the conclusion, had persuaded themselves or reasoned themselves into a theism, though it might still be far from monotheism, and into a belief in some form of immortality after death, even though they might deem the life of the humblest farm-drudge on earth to be better than the kingship of the shades.[2]

[1] Tennyson, *The Lotos eaters*, Choric song viii.
[2] Homer, *Odyssey*, Book xi., 488.

But the great thinkers of olden days, Socrates, Plato and Aristotle, the Stoics and other schools of philosophy, much as they might differ in their points of view, their metaphysical systems, and the amount of their detachment from the current polytheism, were at one with the teaching of Hebrew prophets, that " in the beginning God created the heaven and the earth," and could say " God is near you, with you, within you. . . . A holy spirit sits within us, spectator of our evil and our good, and guardian. Even as He is treated by us, He treats us. None is a good man without God. Can any triumph over fortune unless helped by Him ? He gives counsel, splendid and manly ; in every good man, ' What God we know not, yet a God there dwells.' The Gods are not scornful, they are not envious. They welcome us, and, as we ascend, they reach us their hands. . . . God comes to men, nay ! nearer still ! He comes *into* men. No mind (*mens*) is good without God. Divine seeds are sown in human bodies, and will grow into likeness to their origin if rightly cultivated." [1]

We must not give too much weight to an argument founded on the very general consent of those who then thought about such questions, but we are justified in taking account of the fact that there is a wide agreement on two points ; these being, that atheism, as maintained by Comte, is the least plausible hypothesis which has been offered as an explanation of the ' Riddle of the Universe,' and that there exists, as Herbert Spencer insists, an infinite and eternal energy from which all things proceed.[2]

[1] T. R. Glover, *Conflict of Religions in the Early Roman Empire* (1909), p. 61, quoting from Seneca.

[2] The words of these authors are fully quoted on p. 28.

Thus we may confidently claim that the recent advances in science have in no way made theism more difficult—rather they have produced the opposite effect by disclosing the marvellous complexity both of the world in which we live and of the forms of life with which it is and has been tenanted, and by making it certain that this process of life and death, of becoming and changing, instead of being compressed into a few thousand years, has been at work for more than a few millions, during all which time the tree of life has been bearing new, varied and more perfected fruits.

It may be true, in one sense it is true, that, as was written on the veil which shrouded the shrine of Isis, "I am that which is, shall be, and hath been; no mortal yet hath raised my veil," but, even if to do this be impossible (as any approach to a complete revelation must always be), we may yet be able to see glimmerings of the 'light which never shone on sea or land,' may be convinced that the shrine is not empty, but is the dwelling-place of a Presence, which, whether we call it Power, or Mind, or what we will, is in very truth the Spirit of God.

Note on p. 69.—The human skull and mandible discovered in an ancient gravel at Piltdown, near Fletching (Sussex), an account of which appeared last March in the *Journal of the Geological Society* (vol. lxix, p. 117) has not been mentioned, because, though it probably represents a very early ancestor of Man, the specimens are in a provokingly fragmentary condition, and additional evidence as to the geological age of the individual, from whose body they came, is much to be desired. We may hope this will be obtained by further research.

CHAPTER III

THE IDEAS OF RELIGION AND THEIR DEVELOPMENTS

TO give a precise definition of religion seems almost as hopeless as in the case of life. One aspect of the difficulty is very well put in the following words.[1] The definition " ought to apply to nothing but religion, and to differentiate religion from everything else, as for example, from imaginative idealization, art, morality, or philosophy "—a distinction which recalls to memory the divorce which has been attempted of substance and accidents; for the latter are not the former though they cannot be separated from it—but, as in regard to life, we entertain a general notion which is sufficient for most purposes. For our present purpose it is also not necessary to make more than a rough classification of religions. The primary and most elementary type—that with which probably all races of mankind began and from which a few have not yet emerged—is Naturism—some form of nature worship. It is the first of which we have any knowledge, but we must remember that in all probability we do not know more of the very earliest stages of the religious idea than we do of the pre-protoplasmic forms of life. Nature-worship exists still among the most uncivilized of races; it represents the beliefs

[1] *Chambers' Encyclopædia:* " Religion."

which two or three thousand years ago were entertained by myriads of mankind ; it is deeply rooted in the human breast, even at this day and in Christian lands, the symptoms being often patent in the child and latent in the adult. It may be ousted by reason, or expelled by the 'points of the pitchfork,' but back it comes after a time.[1] Probably no people are entirely without some notions of religion, though these may be of a very rudimentary kind. It has been asserted that a few such exist, but this has always been disproved on more careful examination. Some tribes among the natives of Australia were once said to be in this condition, but now that trained anthropologists, sympathetic in character and patient in investigation, have won their way into the confidence of these people, it has been discovered that these wanderers all the while entertained definite beliefs in regard to supernatural beings, who were worshipped with elaborate rites and ceremonies, and that, so far from being in a state of absolute ignorance on such subjects, they regarded them as mysteries too sacred to be mentioned, or even hinted at, to those of another race. They had, in some way or other, arrived at ideas of supreme beings, of right and wrong in accordance with the will of these, however strange their ethics might sometimes seem to us ; hence, after this discovery of the error, which arose from placing too much reliance on negative evidence, we may be justified in believing that some idea of religion is existent in all races of man, at any rate in the stage of which we have any real knowledge.

[1] Naturam expellas furca tamen usque recurret. Horace, Ep. i. x., 24.

The belief in spiritual existences, which of course is implied in nature-worship, and which is regarded by Dr. Tylor as the minimum definition of religion, may be considered to have arisen from the attempt to solve two problems which must have exercised the primitive mind. "First, what is it which makes the difference between a living body and a dead one? What causes waking, sleep, trance, disease and death? In the second place, what are those human shapes which appear in dreams and visions? The savage makes these two groups of phenomena each help to account for the other, by combining both in the conception of an apparitional or ghost soul, which is conceived of as an insubstantial human image, resembling a vapour or a shadow, the cause of life and thought in the individual it animates, capable of leaving the body and appearing to men waking or asleep as a phantasm separate from the body of which it bears the likeness, and able to enter into, possess and act in, the bodies of other men, of animals, and even of things inanimate. . . . These spiritual beings fill all nature, animate and inanimate, and their life is a continuation, and not a new life, in savage religion. They transmigrate into human beings, animals, plants, and lifeless things, and they can avenge their past and present wrongs by bringing disease upon the offender. The man keeps after death the temper he had in life, and is powerful for good or evil according to his inclinations when alive. From this, and not from mere family affection, arises naturally the ancestor-worship which has been from remote antiquity, and is still, the main faith of the larger half of mankind." [1] Animism is perhaps almost innate,

[1] *Chambers' Encyclopædia:* "Animism."

even now, in highly civilized peoples; the child needs little temptation from its nurse to beat the table against which it has knocked and hurt itself. The idea is manifest in the *ka* or disembodied shape, which was an established belief among the ancient Egyptians centuries before the earliest pyramid-builders. It is inseparable from the transmigration of souls, which is an essential part of the creed of the Buddhist as well as the Brahman, though holding in the former a less prominent position, and it was an element in the popular beliefs of ancient Greece and Rome. Vergil's picture of the shades in the nether world is more poetic and enters much more into details than that drawn by Homer in the *Odyssey*,[1] but even he carries it so far as to depict the shade of Deiphobus, still disfigured by the frightful wounds which had been inflicted on his body.[2] The meads and groves of Elysium were apparently material, but the illustrious men of olden times, who dwelt in them after death, were unsubstantial representations of their original forms, their bodies only a phantom.

But these legends belong to stages which are not the earliest in the evolution of religion. Material objects had indeed their 'doubles,' otherwise the dead would have been unprovided with clothing, armour, weapons, chariots, and food, but the idea of the actual indwelling of a spirit in a material form on the upper earth had now passed into the realm of legend. The primitive view of the universe was that described by W. Robertson Smith in the following passage:[3] "The oldest institutions of

[1] See Book xi.
[2] Vergil, *Æneid*, vi., 495 and 638, etc.
[3] *Religion of the Semites* (1889), p. 83.

religion—and by this I do not mean such institutions only as became obsolete at an early date, but such as survived and played a considerable part in religious life down to the later ages of heathenism—carry with them evidence to [*sic*] a conclusive kind, referring their origin to a time when men had not learned to draw sharp distinctions between the nature of one thing and another. Savages, we know, are not only incapable of separating in thought between phenomenal and noumenal existence, but habitually ignore the distinctions, which to us seem obvious, between organic and inorganic nature, or within the former region between animals and plants. Arguing altogether by analogy, and concluding from the known to the unknown with the freedom of men who do not know the difference between the imagination and the reason, they ascribe to all material objects a life analogous to that which their own self-consciousness reveals to them. They see that men are liker to one another than beasts are to men, that men are liker to beasts than they are to plants, and to plants than they are to stones ; but all things appear to them to live, and the more incomprehensible any form of life seems to them, the more wonderful and worthy of reverence do they take it to be. Now this attitude of man to the natural things by which he is surrounded—an attitude which in modern times is known to us only by observation among savage races—is the very attitude attested to us for ancient times by some of the most salient features of antique religion."

In illustration of this primitive animism, that author quotes a number of legends, which illustrate a belief not only of the mutation of form between men and animals, which survive at the present day in stories

about lycanthropy, vampires, witches changing themselves into hares and the like, but also in those of centaurs, of the armed crop that sprang from the dragon's teeth sown by Cadmus, of the tree into which the mother of Adonis was changed and from which the child in due course was born. He tells us that in the Sinai district the hyrax and the panther are believed to have been originally men, and that Mohammed would not eat lizards because he fancied them to be the offspring of a metamorphosed clan of Israelites. The Babylonian legends represent beasts as well as men to be formed of earth mixed with the life-blood of a god. In Greek we find legends of the descent of men from gods, side by side with those of men sprung from trees or rocks, or of races with a tree for a mother and a god for a father. Similar myths, connecting both men and gods with animals, plants and rocks, are found all over the world and were not lacking among the Semites. To this day the name of the Beni Sokhr tribe is explained by making them offspring of the sandstone rocks about Madāïn Sālih.[1] Indeed, the same idea may be found in a spiritualized form in the Genesis account of the creation of man, but here his body only is made from the 'dust of the earth,' his life is the breath of God.[2]

By degrees, as the distinction between the living and non-living became more strongly appreciated, restrictions would be introduced into the general animism, and the conceptions of deities become more distinctly anthropomorphic. They would be idealized men, far greater in power, but with similar wants, desires and passions; possessing an outward form, though one mutable at the

[1] *Ut supra*, p. 86. [2] Genesis ii. 7.

owner's will, and a substance which could receive a wound, though but rarely a mutilation, and was incapable of death. That is the stage represented by the Gods of the Iliad—that to which probably the more advanced races of the Eastern Mediterranean had attained at the close of the bronze age. Hephæstus was permanently lame, either from his birth or in consequence of having been hurled by Zeus from heaven to earth; Aphrodite was wounded on the hand by the spear of Diomedes; [1] Zeus himself with all the gods left his bronze-floored palace on Olympus uninhabited during the twelve days of his visit to the 'blameless Æthiopians; [2] so that the Deities themselves were not free from the limitations of humanity, though for them the bonds of time and space were comparatively light. From the first, we should imagine, there could not have been, even in animism, a complete equality among those localized deities, and we may regard it as certain that, so soon as the anthropomorphic idea obtained a footing, there would be distinctions and differences of power. One man is stronger, quicker, cleverer than another; one, relatively benevolent, another malevolent, and these faculties and dispositions would exist in their wraiths, but with greater power of effecting their will. Some of them also would be more potent than others, for a condition of strict equality in power cannot ever have existed among man; the parent, at first, is the natural ruler of the family, and when the aggregation of families begins, some man, more capable than the rest, will be-

[1] *Iliad*, v., lines 333–342.

[2] *Idem*, i., lines 423–6. Compare the taunt addressed by Elijah to the Baal-worshippers (1 Kings xviii. 27).

come chieftain of the tribe or clan, and there will be, as organization develops, a gradual transition from democracy to autocracy. The ' king ' idea has its roots very far back in the natural dominance of the father of the family—a thing inevitable for a time—just as the beginning of nationality is found in the banding of families for mutual defence against either predacious animals or enemies of their own kind. Even the stage of the most indisputable autocracy is reached comparatively early in the growth of civilization, for in some African tribes, which had advanced but little beyond the stone age, the power of the chief over the life and property of his tribe was as absolute as that of any Oriental despot.

It has been sometimes said that " the original Semitic conception of the Godhead was abstract and transcendental ; that while Aryan religion with its poetic mythology drew the gods down into the sphere of nature and of human life, Semitic religion always showed an opposite tendency, that it sought to remove the gods as far as possible from man, and even contained within itself the seeds of an abstract deism." [1] But Robertson Smith declares that to be an unfounded assumption. It is true that in later times the more abstract theological ideas germinated more freely in Eastern than in Western minds, for to the one group (to make use of a simile) ' pure mathematics ' would have been the more attractive, to the other ' applied mathematics,' but no trace can be found of this distinction in the earliest known times. The dominant religion in the east, and, so far as we know it, in the west also, was an anthropomorphic

[1] *Ut supra*, p. 49.

polytheism, of a rather low type, with a large survival of the primitive animism.

But another conception of a ruler must have arisen, even while this animism was still prevalent, which would soon become inseparable in practice, whatever it may have been in theory, from the notions of Gods—an authority which might sometimes co-operate with, sometimes be in opposition to that of chieftain or king. In every society, large and small, there will be, especially in that wide realm which lies outside the one of direct sensation, those who lead and those who like to be led. From this distinction will arise the magician, the medicine-man, and ultimately the representative of sacerdotalism, as it is commonly designated. When a sense of helplessness, produced by the greater natural phenomena, such as tempest, lightning and pestilence, affects the majority, men would come forward who claimed to have, or somehow got the reputation of having, a power of controlling these, which was not possessed by their fellows. Such men would be at first those more liable to vivid dreams, trances, or perhaps even seizures of an epileptic character. Sometimes they might only be more self-assertive or ambitious, but might prefer a course in which physical strength was unnecessary; they might also better gauge the weaknesses of their fellows, and perhaps be naturally more dexterous in the conjurer's arts, but, however it might be caused (and probably that would not always be in the same way), persons would soon come to the front, who would claim to be the intermediaries between the people and their gods; to be augurs and utterers of oracles, to be authorities in ritual, and sometimes to be able to limit the powers even of the deities, by

compelling them to cease to harm or even to show favour to their worshippers. In some cases these men might attain to an authority no less potent than that of the king, and become, less ostensibly, though more really, the actual rulers. Some phase of this may be observed in most forms of animism and in perhaps all of polytheism ; in these, as civilization advances, the augur and the propitiating priest gradually replace the mere magician, who is more self-seeking and sometimes more malevolent than they.

Polytheism also may be said to expand as the national idea develops, throwing out, as it were, two branches from the single stem. In the one case the peaceful fusion of two tribes brings about a union of their deities, which may also be permitted from motives of policy, when one has conquered the other ; indeed, it will probably occur in most cases, because the natural clinging to inherited beliefs will lead men to defy all persecution which falls short of extermination. Thus the gods become more numerous, but the distinctions of rank among them tend to increase. Still, just as the tribal chieftain's power may increase until it becomes despotic, so some one of the deities in the Pantheon may bring the others more and more into subjection, till they are reduced into being nothing higher than the executors of his will ; supernatural indeed, but with little or no independence of action. At last that deity stands in solitary pre-eminence as the seat and source of power. But this power can only be exercised within the nation : the god's authority has territorial limits. Beyond these there are other rulers for other nations, with whom he either must not interfere or must fight for supremacy.

This idea—that of the one God for the nation—which is a stage intermediate between ordinary polytheism and true monotheism bears the name of henotheism.

To this the Semitic races either were approaching or had approached in the centuries following the exodus of the Hebrews. No doubt, as we shall presently endeavour to describe, a few leaders of the latter had gone yet farther and attained to monotheism, but to the great mass of the people Jehovah was a god, who, within the limits of the nation admitted of no competitor, but beyond these might have rivals. Further than henotheism, the mass of the people seem to have been unable to get, and even held very loosely to that. The words of the Syrians in the days of Ahab, King of Israel, show clearly the position of that nation, which not seldom was also that of the Hebrews. "Their god is a god of the hills, but not a god of the valleys." [1] This was said almost nine centuries before the present era, and the historical books of the Old Testament make it plain that there was a constant struggle between the henotheism or occasionally monotheism of the few enlightened sons of Israel, and the nature worship and polytheism of the neighbouring Semites. The people, in Biblical language, were always going after strange gods; now Ashtoreth and Baal, the female and male divinities of the Sidonians; now Chemosh the abomination of the Moabites, or Milcom of the Ammonites, and the blood-stained Molech, perhaps identical with the last-named. The golden calves themselves were a reversion, like that set up under Sinai, to the worship of Egypt. Altars to strange gods were repeatedly erected in the precincts

[1] 1 Kings xx. 23, 28.

of the temple, and its builder began the practice; the reformation of Hezekiah was followed, immediately after his death, by a sanguinary reaction, and even that carried out by Josiah, some sixty years later soon proved to be a failure. The captivity with its bitter discipline, seems to have been the cautery which extirpated idolatry and the worship of strange gods; for the Jews returned to the inheritance of their fathers with a monotheistic faith so deep and strong as to defy persecution and nerve them to suffer and even die in its defence.

But the early history of monotheism, whatever and whenever may have been its origin, to which question we must refer in the next chapter, seems to have resembled that of a species which is struggling to establish itself. It may have appeared from some sudden synthesis—the result of fortunate intuition in one man's mind—like that new species of *ænothera*;[1] or it may have been the result of a gradual process of reasoning, but its announcement becomes more distinct, its adherents more numerous, during the later times of the monarchy.[2] It is in the prophetical writing that we find for the first time the true character of Jehovah. Amos, "the father of written prophecy,"[3] about 800 years before the present era, bids the house of Israel seek the Lord "that maketh the Pleiades and Orion and turneth the shadow of death into the morning, and maketh the day dark with night; that calleth for the waters of the sea, and poureth them out on the face of the earth." A little earlier he declares:

[1] See p. 49.

[2] Historical Books, other than those entitled Kings and Chronicles, are not quoted, because of the difficulty of ascertaining the date of any particular section or passage in them.

[3] W. Robertson Smith, *The Prophets of Israel* (1882), p. 75.

"The Lord, the God of hosts, is His name, that formeth the mountains, and createth the wind, and declareth unto man what is his thought, that maketh the morning darkness, and treadeth upon the high places of the earth." [1] These may suffice, but similar declarations are repeated by other prophets during the next three centuries, showing that they had discarded the limited conception of a merely national God, and were striving to bring the people to realize in Jehovah the God who 'filled heaven and earth,' who had "made the earth by His power, hath established the world by His wisdom, and hath stretched out the heaven by His understanding. When He uttereth His voice there is a multitude of waters in the heavens, and He causeth the vapours to ascend from the ends of the earth; He maketh lightnings with rain and bringeth forth the wind out of His treasures." [2] Or, again, in simpler phrase "that ye may understand that I am He; before Me there was no God formed, neither shall there be after Me. I, even I, am the Lord, and beside Me there is no Saviour. . . . I am the first and I am the last, and beside Me there is no God." [3]

But in sources of information regarding religious beliefs among Semitic nations, the dates of which can be assigned with greater confidence, we can see that, at a very early period, approaches were being made towards monotheism. From the welter of animistic survivals and crude poly-

[1] Amos v. 8, iv., 13. [2] Jer. xxiii. 24, li. 15, 16.

[3] Isaiah xliii. 10, 11, xliv. 6. It is true that these quotations are from the "Deutero-Isaiah" portion, but that is generally admitted to be exilic in date, and it was during the captivity, as we can infer from the writings of Ezekiel, that monotheism began to spread among the people.

theism in which the great majority, especially of the humbler folk, were involved, thoughts sometimes emerge which rise far above the common type. In hymns recovered at the ' temple college ' in the city of Ur in Chaldea—whence Abram is said to have come—hymns dating back ' certainly to the twenty-fifth century before the Christian era '—we find such lines as these :—

" Father, long suffering and full of forgiveness, Whose hand upholds the life of all mankind. . . . In Heaven, Who is supreme ? Thou art alone supreme ! In Earth, Who is supreme ? Thou art alone supreme ! As for Thee, Thy will is made known in heaven, and the angels bow down their faces. As for Thee, Thy will is made known in earth, and the spirits kiss the ground. . . . As for Thee, Thy will has created law and justice, in that man by it has made a law. . . . As for Thee, who can explain Thy will ; what can rival it ? " [1]

Very early also did grander and nobler thoughts arise among that great multitude, so diverse in origin, with which Hindustan is thronged. Here also is a substratum of the crudest animism, which is still the sole creed of certain hill-tribes who are probably the representatives of the earliest inhabitants ; but the creed of the vast majority is an elaborate system of polytheism, and above it rose—perhaps some two thousand years before the present era—a creed, which was in some respects a vague foreshadowing of that afterwards maintained by the Christian Church—the great triad of Brahma, Vishnu and Siva. Brahma, as Sir Alfred Lyall stated,[2] " is usually described

[1] W. St. Chad Boscawen in *Religious Systems of the World* (1892), p. 19.

[2] *Idem*, p. 115.

as the Creator, the self-existent ; and it is supposed that he stands for the original creative intelligence which produced the visible universe, so to speak, out of nothing." But he has become a philosophic conception rather than a Divinity who rules and is concerned with the machinery which he has originated and set in motion. A Being with so remote an influence and such vague functions fails to impress the popular imagination. In this, accordingly, Vishnu is the more important deity. But even he is depicted in a state of blissful repose, for " tranquility, not activity," is the supreme type of the highest Hindu deities. Vishnu, however, unlike Brahma, can be awakened by the prayers and offerings of worshippers, can be induced to descend to earth and set matters right. " These descents are his famous incarnations." Siva stands in strong contrast with Vishnu. He has charge of the whole circle of animated existence, the incessant round of birth and death. He is not known, like Vishnu, by embodiment, but through the great natural forces of destruction and reproduction. The triad of Hinduism—Brahma, Vishnu and Siva—" have an inner and an outer meaning—a popular shape and a mystic interpretation. They represent the principle which runs like a spinal cord right through all Hinduism, connecting the higher intelligent religions with the lower beliefs." They seem also to hint at that dualism—the antithesis of light and darkness, good and evil, spiritual and material, which in the East apparently springs up almost spontaneously ; but in any case the system shows that at a very early date the leaders of thought had risen far above the commonplace polytheism of the multitude.

The fundamental doctrine of Buddhism, which as

being, in a sense, a reaction from Brahmanism may be more briefly dismissed, is stated in the following terms : " that there is nothing either divine or human, either animal, vegetable, or material, which is permanent. There is no Being, there is only Becoming. That is true of the mightiest of the Gods, as much as of the tiniest material atom."[1] Thus the aim of its votary is to divert his thoughts from all mundane objects, to obtain complete mastery over his thoughts, desires and passions, to become ' Lord of himself ' in the best sense of the words, and to seek by constant effort to attain in this life to a state of perfect peace, so that he may pass, when it is ended, into that repose where all sense of individuality, the source of every evil, has been lost—the repose of Nirvana.

Something of this dualism may have percolated westward at a very early period, though its influence became more prominent, as we shall presently see, in early Christian times. But some trace of it may be perceived in the ancient legends of the older and younger gods ; the ' war in heaven,' which ended in the defeat and expulsion of the one and the autocracy of the other. Something of this kind may be found in that mysterious drama of the Prometheus Vinctus. Æschylus, as he was born before the days of Sakya-muni, cannot have been in any way affected by his teaching,[2] but it is remarkable how we find the hero of his drama not only scorning those ' upstart gods who lord it in newfangled ways,' but also declaring that there is a Power—Anankē, Necessity or Fate—stronger than Zeus himself, at whom he hurls a final

[1] See T. W. Rhys-Davids. *Idem*, p. 142.

[2] The birth of Æschylus is given as 525 B.C. That of Sakya-muni, the Buddha, is placed sometime in the fifth century, B.C.

defiance as he sinks from view, undaunted by the elemental war and secure that a day will come when wrong shall be righted.

Pantheism has hitherto not been discussed because it is a phase of philosophic thought which is latent in some of the above-mentioned religious systems, and may be regarded as an incomplete presentation of the truth asserted by monotheism rather than as a system by itself. It is a very great advance on animism and polytheism in that it attempts to unify the variety of powers which they present to their followers. It is a system of philosophy rather than of religion, which seeks to penetrate beyond the diversity of phenomena to the unity of cause, and may be said, if we express metaphysical ideas in the terms of science, to explain everything by the principle of the conservation and the dissipation of energy. But in any case, we think, that the pre-Christian religions show an evolution, similar to that which has worked upwards from the lower to the higher among living creatures in the conception of the mystery which lies ' beyond the veil.'

CHAPTER IV

THE PROBABILITIES OF A REVELATION

IN our first two chapters we endeavoured to show that the history of the earth, whether we study it from the side of chemistry and physics or from that of biology with the aid of palæontology, affords evidence of a great process of evolution, which is exhibited by all things, both non-living and living, and has been at work from the most remote ages of the past down to the present time. As we endeavoured to watch this process, there passed before our eyes, in the one division no less than in the other, a marvellous series of forms, extending from the most simple and rudimentary—scarcely worthy of the name of structure—to the most complex and specialized, which have followed, and in the case of the individuals still do follow, a path that is in every case definite and unalterable within all but the narrowest limits. When we ask ourselves the question—and it is one which cannot be avoided—Is this regular and orderly progress the result of a purposeful intention, design, or law, or has it been brought about by the fortuitous clashings and entanglements of things which are ever so much more minute than the chemists' atoms, and are the limit to our powers of investigation? Approaching the matter, so far as we can, without prejudice, we can only say that the latter reply appears to us far less probable than the former. Some people,

however, seem to think that they can escape from the dilemma by talking of the 'principle of causality' or some other phrase equally vague. But any such phrase affords no more assistance to our mental difficulties than a cheque drawn on the 'Bank of Elegance' does to an empty pocket. We feel unable to refrain from asking What is the cause of the law of causality? That law, like all those which we so often talk about as existing in the natural world, is merely an induction, founded on careful observations, in regard to the sequence of phenomena. It is, after all, no more than an instance of the 'how' of things; what we are wanting is to be brought a little nearer to the 'why.' That we can never hope to discover in all its fulness, but, if by Theism we understand a belief in an omnipotent, all-wise and eternal Being, by Whom and in Whom, all things consist, we submit that inductive reasoning from all the phenomena, which we are capable of observing, leads to the conclusion that the 'Why' must be sought in the existence of such a Being, or, in other words, that the Natural Sciences are favourable, instead of being hostile, to Theism.

We have seen in the last chapters that the ideas of religion, entertained by our own race, so far as we can study them either at the present or their history in the past, are also suggestive of a process of evolution, and must necessarily be the result, either of a rather orderly succession of utterly baseless illusions or be a witness to the truth of some form of theism, even though the apprehension of it may still be far from perfect.

Most religions lay claim to inspiration in some form or other, to be the means of conveying to men messages from, and other informaton about, the unseen power and an

unseen world. These come through the medium of individuals—men or women—who have been specially favoured. This knowledge may be imparted in different ways. Sometimes it is obtained in dreams and visions ; sometimes from oral communications—like the still small voice on Horeb, or the commands of the Captain of the Lord's host to Joshua ; sometimes it is received in such visions as that of Isaiah when he saw " The Lord sitting upon a throne and His train filled the temple," or when St. Paul was " caught up to the third heaven " and " heard unspeakable words what it is not lawful for man to utter." Sometimes the messages were the utterances of special persons, in a temporary state of frenzy, like the Pythia at Delphi or the fabled Sibyl at Cumæ—

> " Cui talia fanti
> Ante fores, subito non vultus, non color unus,
> Non comtæ mansere comæ ; sed pectus anhelum,
> Et rabie fera corda tument ; majorque videri,
> Nec mortale sonans : afflata est numine quando
> Jam propiore Dei." [1]

Sometimes, however, they came from the interpretation, by persons supposed to be qualified, of dreams, of omens, or of anguries. To communications of this nature, in some form or other, almost, if not quite, all kinds of religion lay claim. To speak only of Judaism, with which we are more immediately concerned, we may call to mind the answers often sought from dreams, from prophets, from lots and from the mysterious Urim and Thummim, and modes of communication, in some respects similar, are mentioned, as was intimated above, in the New Testament. We may, however, notice that the frequency of

[1] Vergil, *Æneid*, vi. 46–51.

these supernatural modes of instruction, their abnormality and their paroxysmal character, diminishes with the advance of civilization and of systematic thought, and the more violent types are then more often attributed to the action not of a good but of an evil spirit.

In early days the claim to inspiration was often fraudulent and the medicine-man or magician merely a clever impostor, but in not a few cases he may have been really self-deceived, and influenced by impulses from within which he thought genuine. Hypnotism, though it has been overladen with, almost buried beneath, a mass of deception, is a real thing, and a man can sometimes hypnotize himself as well as others. Dreams may be the results of unconscious cerebration—the most unimaginative persons have sometimes recalled a forgotten fact or worked out a problem in their sleep, and the border line between normal and abnormal states, under certain physical conditions, is one very difficult to draw. There may be operations of the ' sub-liminal self ' by which some of these strange phenomena may be explained, to which, however, we must not do more than allude, for to enter upon them fully would occupy too much space, but I can remember to have heard statements, the good faith of which could not be doubted, concerning incidents and experiences which would be most easily accounted for, either by this hypothesis or by some form of trance.

If then theism be true, and if the spiritual evolution of mankind, no less than his physical, be a part of the Creator's design—which, as we have been endeavouring to show, seems suggested by facts—we may expect that there will be revelation in regard to things, for the discovery of which the human senses and intellect are inadequate,

provided, of course, that the knowledge of them is a help to the ascent of that Bethel-ladder which leads from earth to Heaven. The objection, however, may be urged that the evolutionist, while prepared to believe in some form of revelation, is precluded from accepting any one which is not gradual in its action, like the ordinary processes of growth. But we must remember that there are not a few authorities in zoology, who would strongly repudiate anything like creation, as this was formerly understood, and yet believe that there are occasionally 'jumps' in the passage from one species to another, and many suppose, that, notwithstanding a recent discussion, a break can still be found between the animate and the inanimate, between living and dead protoplasm, and even if we admit that, as we have endeavoured to indicate, everything may be reduced to ether and electricity, yet even then a gap exists between that ether and its 'granulated' state as matter.

Accepting then, as a working hypothesis—the most probable under the circumstances—that the God of the Theist does sometimes and in special cases reveal Himself to man, what tests can we find to distinguish the true from the false in the alleged communications. We will not appeal to 'miracles' which must be reserved for a separate discussion, but seek at present for tests which are, so far as is possible, independent of those incidents. Such tests may be grouped under three heads: (1) the character of the messenger; (2) the ethical tendency of the message; (3) its reasonableness.

In regard to the first, we may be rightly distrustful of anything which comes from a man, whose life is distinctly evil. We cannot indeed deny that, as the homely proverb

puts it, the Devil may sometimes tell the truth, but we must not forget the conclusion that, if he does, it is for his own advantage, and so we shall be wise in rejecting all that comes from an obviously corrupt source. It is better to throw away one wholesome mushroom, even though we are hungry, than to eat it with a lot of poisonous funguses. But in applying this test, we must judge the man by the standard of his age, not by that of our own or of our own nation, and we must also consider whether his lapses, if any, from that standard were isolated or habitual. Concubinage or polygamy are now repudiated by public opinion and even forbidden by law in Christian countries, but we do not deem these to be sins in the patriarchs, any more than we condemn the religious leaders of the Jews in ancient days for the slaughter of the hostile tribes of Palestine. Though David, in the matter of Bathsheba and her husband Uriah, committed a great sin, even according to the moral standard of his own age, we do not, since his repentance was sincere, put the less value on a psalm which may have been written by him. Though we cannot defend Peter's denial of his Master, we remember that he speedily ' came to himself ' and ' wept bitterly,' so that afterwards he could say with perfect sincerity, " Lord, Thou knowest all things, Thou knowest that I love Thee ! " But we should attach small value to the oracles, did any such exist, of the two sons of Eli, of Joab, of Gehazi and of Simon Magus.

In regard to the second test, the ethical tendency of the message, we have to consider whether it rises distinctly above that of the age in which it was delivered. It may suffice, for the moment, since we must presently consider the whole question of the inspiration of the Bible, to refer

to the abhorrence of idolatry and of all the degrading vice and savagery often associated with it which characterizes even the most ancient parts of the Old Testament, and to the increasingly high ethical standard set up, first in the prophetic books, and then in the teaching of Christ, as compared with that of the accredited exponents of the law. It was a true report of Him, which the officers of the Sanhedrin brought back : " Never man so spake."

Thirdly the reasonableness of the message. By this I mean whether it commends itself to our mental as well as our moral faculties, deepens our insight into the mysteries which lie outside the things which our unaided senses can apprehend, and lifts us to a distinctly higher ethical stage, as is done by that precept in the Mosaic Law, ' Love ye the stranger,' [1] or that in the yet more perfect one ' Love your enemies, do good to them that hate you, bless them that curse you, pray for them that despitefully use you.' [2] We do not regard as characteristics of a revelation either truisms or commonplaces, or, if the phrase be permitted, the kind of twaddle, harmless, no doubt, but not edifying, that is too common in the discourses of many good and well-meaning men, but we do expect an uplifting of the veil, though it be but for an instant, a disclosing of some great truth of which, hitherto, the wisest have barely caught a glimpse.

If we apply these tests to the Old Testament, we may boldly claim that they show many parts of it to have come from a source which is something more than human. I do not attempt to maintain that the same can be said of all parts of it. The most that, in my opinion, can be

[1] Deut. x. 19 ; cf. Exod. xxii. 21 ; Lev. xix. 33, 34.
[2] Luke vi. 27–28.

asserted for the historical books is that, as a rule, they narrate, as carefully and accurately as was in the power of the writer, the incidents recorded, but that we are not called upon to admit their authority without carefully considering the statements themselves and searching for corroborative evidence. Yet in these books sometimes, as in the prayer of Solomon at the Dedication of the Temple, the speaker rises above the henotheism dominant in the age of the monarchy, while the prophets, as has already been said, are like beacons set on a hill to guide men to heights of knowledge which they could not otherwise have reached. But we find not the least remarkable instances of a real inspiration in some of the very books, the value of which the followers of science are accused of despising. The opening chapters of Genesis were formerly supposed to give the history of the early days of the earth even more accurately than the Annals of Tacitus do that of his own age. We must frankly admit that at the present day no geologist of any repute would accept the narrative of the Deluge or that of the episodes of Creation, as actual and literal history. Records of both of these are to be found on the clay tablets which once formed part of an Assyrian library, and they may be traced back from the later days of that monarchy to the times when the Semitic had hardly began to blend with the Sumerian race. The following statement, made more than twenty years ago, rests now on yet more ample evidence than when it was first written.[1]

" When we examine the records of the religion of these ancient Chaldeans, we are astonished to find therein narratives of the Creation, of a Paradise—perhaps also of the Temptation and Fall of Man—of a great Flood and

[1] The author *Old Truths in Modern Lights* (1891), pp. 156–160.

of a subsequent dispersion of mankind, which not only present such a strong general resemblance to, but also exhibit so many minute coincidences with, the earlier chapters of Genesis, that we cannot doubt that both have a common origin." But so far from reducing the first eleven chapters of Genesis to a mere collection of folk-lore, we may justly maintain that they are in the truest sense inspired. "Every one of these stories in the Chaldean version is, so to say, 'saturated with polytheism,' for the Chaldean religion was a polytheism and this had been further degraded by the old Accadian influences. One example will suffice. When Hâsisadra, the Chaldean Noah, goes forth from the ark, he offers a sacrifice, and to it, we are told, 'the gods swarmed like flies.' The Hebrew account of the early history of the world has been purged from every trace of polytheism, and it proclaims that the God of Israel is one God, Creator and Maker of the heaven and the earth, of all that is and all that lives."

It is of course difficult to say precisely to what period the process of expurgation and reconstruction of these parts of Genesis is to be attributed. The book, we believe, is now generally admitted to be composite, though scholars differ about several points of detail, which sometimes are not without importance. The Creation story obviously consists of two documents which, instead of being welded together, have been left almost independent; one, the second, being considered to be the more ancient. The dates of neither can be regarded as completely settled, and the Pentateuch certainly shows signs of the hand of more than one editor, but the majority of competent judges are of opinion that the second document (itself a compilation from two others) dates, in regard to one of

them, from the ninth century before our era, and to the other from the early part of the following one, but that the first of the main component documents must be assigned to the earlier years of the exile.[1]

Three explanations may be offered of the fundamental agreement between the earlier portions of the Chaldean and Hebrew records : (1) that the Jews became acquainted with and adopted the former during the Babylonian Captivity ; (2) that the Chaldeans borrowed them from the Jews ; (3) that the Hebrew record was derived at some early period from Chaldean sources, and afterwards improved upon. The first of these explanations is hardly admissible for two reasons ; one, that the captive Jews, as we can see from the well known psalm of lament, so bitterly hated their conquerors that they would not have been likely to borrow from their traditions or religious documents, especially when they were themselves realizing, almost for the first time, the sinfulness of idolatry. The other reason is that both the components of the older document are earlier than the captivity by hardly less, and perhaps more, than two centuries. In addition to this it is highly probable that these components were already ancient at the time when they were put into their present form ; and may belong to a group of documents which preserved the instruction given by the great lawgiver. Be this as it may, we are safe, I think, in rejecting this explanation. The second one may be summarily dismissed ; the Chaldean record was in existence centuries before the date of the Exodus. Thus the third explanation remains—that the Hebrew record was taken at some early period from the Chaldean. This borrowing and the necessary expur-

[1] S. R. Driver, *The Book of Genesis* (1904), pp. xv.–xvii.

gations have been attributed to Moses, and the knowledge of the older cosmogony is supposed to have formed part of the 'wisdom of the Egyptians' in which he was learned. But apart from this statement being only a passing remark, made several centuries after his death, it is not very probable that he would have had the opportunity of acquiring any such knowledge. The religious system and the traditions of Egypt were very different from those of Chaldea, while the two nations, though they overlapped in Palestine, and the cuneiform script of the latter was understood by officials of the former, were opposed in interests, were not seldom unfriendly and were therefore least of all likely to borrow from one another's religious traditions, since the Gods of hostile nations were believed also to be hostile. Nor at any time afterwards do the relations between the Hebrews and either of the great powers in the Euphrates Valley seem to have been favourable to such borrowing. When they come into contact it is, with rare exceptions, as possible or actual foes, so that it seems not improbable that these traditions were brought, and if so, modified, by the 'Father of the Faithful' from 'Ur of the Chaldees.'

Thus the earlier the age—and early it must have been in any case—at which this change was made, the more wonderful it appears, if we consider it to be nothing more than an ordinary process of mental evolution. "All the influences of the age were opposed to it. The stately buildings, the graven images, the polytheistic worship; the elaborate ritual of the more educated; the lingering shamanistic superstitions of the more ignorant—all tended in an opposite direction. At such a time, under such influences, the sudden rise of a pure monotheism,

without a revelation, is a thing, it seems to me, as incredible as Christianity without a Christ." [1]

To one theory of inspiration—that commonly called 'verbal inspiration'—we must return in our last chapter, but we contend that, leaving this entirely on one side, we are justified in adopting Canon Driver's words in regard to the Book of Genesis, which may be extended with due modification to other parts of the Bible. It "is a marvellous gallery of portraits, from whatever originals they have been derived. There is no other nation which can show for its early history anything in the least degree resembling it. There is nothing like it in either Babylonia, or Egypt, or India, or Greece. The mythology of Greece—especially as it stands before us in the two great epics with which Greek literature opens, and as particular episodes of it are made the vehicles of splendid lessons in the great tragedies of a later age—is indeed a wonderful creation of the human mind, and an abiding monument of the intellectual genius of the nation which produced it; but the Book of Genesis stands on a different plane altogether; and even though it be not throughout what our forefathers understood it to be, a verbally exact record of actual fact, this very difference, which distinguishes it so strikingly from the corresponding literature of any other nation, remains still the strongest proof of the inspiration by its authors. The spirituality of its contents, the spiritual and moral lessons, which are continually exemplified by it, and which, though they are often expressed in a simple and even child-like external garb, are nevertheless to all intents and purposes the same as those taught afterwards by the great prophets, constitute a cogent

[1] The author, *ut supra*, p. 159.

ground for inferring the operation of a spiritual agency differing specifically from that which was present when the mythology of Egypt or Babylonia, of India or Greece, was in process of formation." [1]

We may turn now to an argument in favour of a revelation to man, or rather revelations of a more general character and a wider application than when it is restricted to a single people, namely, that we find much difficulty in understanding how man, if left to himself, could feel any certainty about the existences of the unseen world or a personal immortality. He acquires knowledge primarily through his senses; they are his instruments of observation, and his mind deals inductively with the results which they have provided. The conclusions, attained by these methods, may be extended by deductive treatment, but unless the results of it can be tested by experiment—that is, by making use of the senses—they cannot get beyond the position of a working hypothesis; they may lead us, as has been indicated, to theism, but to nothing more definite. But experience shows this position to be too indefinite to be of much real use in the trials and anxieties to which our race is subject. If then inductive reasoning leads us to the conclusion that there is a Supreme Being, Who desires the moral improvement and advancement of our race, it is at least probable that He will make Himself known to man and will give him some notion of the great Ideal to which he should attempt to conform. This it is which we understand by the term 'revelation.' The objection may be made that any such definition concedes too much, because, if we find in the thoughts and philosophies of olden time,

[1] S. R. Driver, *ut supra*, p. lxix.

or even in the cruder conceptions of those who are still wandering in the darkness of polytheism, ideas which we admit to be anticipations of doctrines which are found in the writings of Hebrew prophets and of Christian teachers, we must admit that a revelation was vouchsafed to the one as well as to the other. But with certain restrictions, we are not afraid to make this admission ; for in so doing we only acknowledge that a process of evolution is manifest in religion no less than in the history of matter and life. It is our belief that God has never left the representatives of our race wholly to themselves, to be for countless ages the sport of a Demiurge or of evil demons but has led them gradually onwards and upwards, giving them such knowledge as they could bear, ' precept upon precept ' and ' line upon line,' as the spiritual faculties, to make use of a rather strong metaphor, are developed from an invertebrate to a vertebrate stage.

Another, and a very different, objection may be made, that both Judaism and Christianity are so largely permeated by a belief in miracles that we must either accept them without reserve or reject them altogether. This is an objection of the highest importance and it may save time to take it into consideration before passing on to the subject of Christianity.

CHAPTER V

THE POSSIBILITY AND PLACE OF MIRACLES

EVEN if it be true that, as a general rule, and in one sense of the words, miracles, to quote Hume's statement, are ' contrary to experience,' and ' it is more probable that testimony should be false than that miracles should be true,' this would not justify us in dismissing the subject in the airy manner adopted by some critics—' miracles do not happen.' But we must first endeavour to determine what is meant by the term ' miracle.' Latin in origin, it denotes, in the words of one authority, " any object of wonder, whether supernatural or not," and it is used in our English Bible with a twofold significance : " (*a*) in the *scientific* sense as a portent (*τέρας*), an abnormal event not explicable by known natural laws ; (*b*) in the religious sense, as a sign (*σημεῖον*), an event suggesting the presence and direct action of God." [1] In practice, however, the former word is usually employed to imply the operation of Divine Power not that of an evil spirit, and the latter word may sometimes be extended to include occurrences which in themselves are quite natural events. A third word (*δυνάμεις*) is sometimes used as almost equivalent to the former one, and is represented in English either by Powers or by Mighty Works. This, however, as a rule, has more reference to the force

[1] *Murray's Illustrated Bible Dictionary* (1908), s.v. Miracles.

itself than to its effects. The first of these terms might be applied to the work of a magician, but the second usually, if not exclusively, signifies a manifestation of Divine origin. A miracle, however, in all cases is an event which either in itself or in association with other events, is regarded as out of, or contrary to, the ordinary course of nature—as something supernatural, to use a word, which, as we shall see, is liable to some misconception. For instance, the draft of 'great fishes' in the waters of Gennesaret: 'an hundred and fifty and three,' was a thing which, though a very improbable result of casting a net, even in those waters, was possible in the ordinary course of nature, but it became a 'power' as well as a 'sign' owing to the prediction that it would happen. The giving of sight to a man born blind is a thing contrary to the ordinary course of nature, and thus is a 'power' manifested in a more marvellous way. But the phrase 'contrary to the order of nature' needs to be used with caution, for 'as we know it' must always be understood. The wise words of St. Augustine must never be forgotten: "We say that all portents are contrary to nature, but they are not so. For how is that contrary to nature which happens by the will of God? . . . A portent, therefore, happens not contrary to nature, but contrary to what we know as nature." [1]

The occurrence of a miracle, if we do not rule out the matter in the summary way already mentioned, is a question of evidence, and the more improbable the event,

[1] Portentum fit non contra naturam sed contra quam est nota natura. *De Civitate Dei*, xxi. 8 (translated by Marcus Dods, *Works of Aurelius Augustine*, 1871, vol. ii., p. 429). The whole section contains some curious matter and some shrewd reasoning.

according to ordinary experience, the stronger that evidence should be. It must never be forgotten that ordinary folk are very liable to observe incorrectly or to exaggerate in their report of anything surprising : that when the account is not authenticated by the direct verbal or written testimony of eye-witnesses, the marvels of it are apt to increase in transmission as a snow-ball grows in being rolled over snow. But besides these, there are other and important grounds for scepticism which persons who are somewhat inclined to credulity are apt to forget.

We are justified in viewing with the gravest suspicion any story of a mere thaumaturgy—of anything that, like a conjurer's trick, has only served to increase the performer's reputation or to satisfy some ordinary want of himself or his followers. The old principle of '*dignus vindice nodus*' should always be kept in mind. Thus we have no hesitation in rejecting many stories in the Apocryphal Gospels or later ecclesiastical writers : such as that of the Child Jesus making birds from clay and then causing them to take flight,[1] or, when his pitcher was broken, carrying water from the well in his cloak,[2] or that Francis of Assisi was uplifted from the ground in a state of spiritual extasy and remained suspended in the air, or again that the so-called Holy House was transported through the air by angelic hands from Nazareth, first to the neighbourhood of Fiume and then to Loreto.[3]

[1] Gospel of Pseudo-Matthew, ch. xxvii.

[2] *Idem*, ch. xxxiii., cf. Gospel of the Saviour's Infancy, ch. xxxvi., xxxvii., xlvi.

[3] The first translation is said to have occurred in 1291 ; the second four years later, with a halt at Recanati. It was one of the Holy Places in Palestine, visited and venerated by the Empress Helena about 327 A.D.

Again, we have no hesitation in disbelieving all stories of miracles which are of a merely vindictive character or are actions such as we should condemn in accordance with the ordinary rules of right and wrong, if they had been done in every-day life. Thus we reject with contempt such a story as that of the child Jesus causing boys who had interfered with His play or had jostled Him to fall down dead,[1] or those of the great danger, at any rate in the sixth century, which was incurred by approaching the burial places of St. Peter and St. Paul; so great in the case of the latter that, when a man moved some bones, not of the Apostle himself, but which had been lying in the earth near his grave, "certain awful signs appeared and he died suddenly." We reject these, with others of like kind, though they are vouched for by a man of such eminence in the Church as Gregory the Great.[2]

We view also with the gravest suspicion all stories of miracles which rest on tainted evidence—the testimony of witnesses anything but conspicuous for veracity and honesty. For instance, miracles are said to have occurred both while certain relics of not particularly notable saints were being conveyed from Rome to Germany in the earlier part of the ninth century and afterwards, the authority being no less a personage than Eginhard, Secretary of Karl the Great.[3] But his agents, in the eagerness to gratify their employer's desire to add treasures of that kind to the

[1] Gospel of Pseudo-Matthew, ch. xxvi., xxix. Gospel of the Saviour's Infancy, ch. xlvi.

[2] For the full story of these prodigies, see Gregory the Great Letters, Book iv., xxx. *Library of Nicene and Post-Nicene Fathers*, vol. xii. (translated by James Barmby, D.D.), 1895.

[3] "The Value of Witness to the Miraculous." T. H. Huxley, *Nineteenth Century*, xxv., 438.

monastery which he had recently founded, had stolen these relics and had acted in such a way that " we seem to be reading about the doings of a gang of horse-coupers."

Another group of phenomena, which, if the accounts of them be true, may properly be called miraculous, are justifiably regarded with much scepticism, though the evidence is untainted and the witnesses are persons on whom we should thoroughly rely in more ordinary matters. These phenomena are not only thaumaturgic, but in many cases wholly purposeless. Such are the rising of tables and other material objects from the floor, the tilting of them sideways in the same mysterious manner, without upsetting ornaments and the like, which under ordinary circumstances would slip or fall off ; the lifting of flowers from vases on a table and laying of them on the cloth by invisible hands ; the ' levitation ' of mediums, even to the extent of their gliding through the air in and out of a window ; the materialization of spirits in forms either familiar or strange, and many like marvels, to say nothing of the communication of messages from the unseen world, by table-rapping, ghostly voices, or writing on slates supposed to be inaccessible to the hand of any human being ; messages, it may be remarked, which, though purporting to come from persons who during their life on earth had some literary or scientific distinction, are often couched in rather dubious grammar and are almost always of a very commonplace character. We are also rendered more or less suspicious by the fact that the history of " Mr. Sludge the Medium " in not a few cases has sooner or later been repeated in other prominent members of the profession, so that, between the more than possibility of fraud on the part of the medium and a hypnotized

condition on the part of the few observers, we are justified in paying little attention to these "manifestations of the supernatural." [1]

Excuse has been offered for the apparent inutility of these phenomena in the following terms: "to a very large number of minds these physical phenomena, however low and trivial they may seem, are the most effectual and often the only means of compelling attention to the subject, and this is more particularly the case with those imbued with the teaching of modern science. The moment such are really convinced that physical phenomena occur which they have always held and declared to be impossible, they see that there is something more in the matter than imposture or delusion, and further inquiry shows them that this class of facts constitutes the mere outskirts of the subject." It is not perhaps very complimentary to highly trained leading men in science to put them on the same level as the Galileans [2] who would not believe unless they saw 'signs and wonders,' but at any rate there are important differences between the miracles which convince them and those in the New Testament. The latter were not done, as a rule, in darkened rooms or under circumstances which made observation difficult, but in the light of day and often in the open air. They were not mere thaumaturgies, but for the healing or other benefit

[1] A number of these phenomena are described (from a believer's point of view) in *My Life*, by A. R. Wallace (1905), ch. xxxv.–xxxvii.; and more briefly in *Chambers' Encyclopædia*, s.v. Spiritualism, by the same author. The quotation in the next paragraph is from the latter source.

[2] John iv. 48. The remark was made to a 'nobleman' of Capernaum, but it is clearly inclusive of others, and was apparently applicable to them rather than to him.

of mankind. There are hardly any which would justify scepticism on the ground of inutility.

We must also not forget that a highly trained man of science is not necessarily well qualified for dealing with the phenomena presented by spiritualism. He may be unequalled as an experimentalist in physics or chemistry ; he may be singularly acute in eliminating every source of error in his investigations and in detecting the smallest indication of a significant fact, and yet he may be very easily taken in by a clever impostor. Of the wiles of such persons, scientific men have had no experience in their laboratories and researches ; there, if anything goes wrong, it is because, notwithstanding their best endeavours, they themselves have made some mistake. Nature may indeed play the part of a sphinx, so far as they are concerned ; she may propound to them the hardest and most subtle of riddles, but she will not act as if an ancestress of Ananias. In the examination of so-called spiritual phenomena, especially where a professional medium is concerned, a skilful conjurer would be of far more value than some eminent student of the physical sciences. Still more is this true in regard to the biological sciences, for these, as a rule, do not give even the same experimental training as the physical, so that it may often happen for one eminent in them to be no better qualified to act as an examiner of a new class of phenomena than any other able man. More than this, it is even possible for a man who has risen to great eminence in some one department of science, to be lacking in the power of forming a sound judgment on all other matters, and to be attracted to any opinion, which has failed to commend itself to those equally qualified to estimate its merits.

There are not a few who might adopt for themselves the words of a great scholar, not long since dead, 'I am a hermit too, but whenever there is a fad forward, I come out.'

In regard to spiritualistic phenomena we must not forget the possibility of the witnesses being under the influence of hypnotism in some form or other. Discredited as this influence has been, because of the quackery and imposture which were at first, and to some extent still are, associated with it, the name covers a number of phenomena which well deserve the attention that in later years they have been receiving. "During the hypnotic sleep the patient is uninfluenced by his surroundings and therefore he is all the more open to suggestions and no disturbing influences diminish his powers of concentration. By means such as these, neuralgic or rheumatic pains may frequently be removed; headaches may often be cured, and so may some forms of dyspepsia, as well as the various manifestations of hysteria and hypochondriasis, and even functional paralysis. It is found, too, that hypnotism is useful in dipsomania and in treating persons addicted to opium-eating and other depraved tastes." [1] In fact, 'hypnotic suggestion' may be of great value as an agent for good in educating and in strengthening character, but it is also liable to be perverted to mischievous ends, because, as a person in this condition is "extremely impressionable, and therefore capable of receiving beneficial suggestions, so he is nearly as liable to receive suggestions for evil; and it is quite possible for him during the hypnotic sleep to be impressed with the belief that he is to commit some act

[1] *Chambers' Encyclopædia*, s.v. "Hypnotism."

after he is awakened from the sleep—an act he is safe to do, acting at the time as an automaton" ; indeed, hypnotic suggestion is possible to persons duly susceptible without throwing them, as a preliminary, into a special sleep. Thus some of the above-mentioned marvellous occurrences, which are vouched for by men who would not wittingly deceive, may be the results of hypnotic suggestion to them. The power of the imagination also to affect the health either for good or for ill is now well known to students of medicine and psychology. In this way the individual may produce in himself, or may remove, the symptoms of some diseases ; he may sicken or even die, simply because he believes that he will. Many cures, both in the past and at the present time, are the results of faith healing, as it is now often called, and to this many alleged miracles may be ascribed. Such miracles have not altogether ceased even at the present day. Some sick folk have been cured by relics, but I have no doubt that any bit of bone or stuff would have produced an equally beneficial effect, provided only they had been firmly persuaded that this was what it was asserted to be. I am prepared to believe, though not without careful sifting of every alleged case, that some of those who have visited La Salette, Lourdes, Paray-le-Monial, or any similar cynosure of pilgrims, have been restored to health ; though I think that only certain classes of maladies would yield to this kind of treatment. But that such cures are still sometimes wrought, as they have been in the past, may now be taken for granted ; the only difference is that we have ceased to regard them as miracles, because considerably more is known about them and they can in some cases be produced at will, but even that does not enable us to determine what is the

real cause of which the phenomena are the result.[1]

Many circumstantial narratives of marvellous personal experiences, told in all good faith, may be of little value, because the occurrences were wholly subjective. In certain phases of exhaustion from over fatigue, mental or bodily, from want of food, and the like, the transition from the real to the imaginary is very easy. Probably most of us can remember instances of having passed unawares from a waking to a sleeping state—it may be during a conversation—so that a remark which was begun with a consciousness of our surroundings is ended in dreamland and is transformed into nonsense. In like way a patient may pass from a rational condition to one of delirium, and to an insane man, imaginary persons are no less real than those actually in his company. The visions which sometimes delighted and sometimes tormented hermits and solitaries, whether they dwelt among the burning Egyptian deserts or the East Anglian fens, were the outcome, sometimes of overmuch fasting and self-mortification, sometimes of marsh-fever and ague. Both Marie Alacoque at Paray-le-Monial and Bernadette Soubirons at Lourdes may have thoroughly believed in the reality of the visions in consequence of which crowds of pilgrims are annually attracted to these places, and yet the one

[1] An interesting list of the principal phenomena of hypnotism and its advantages and disadvantages, with a history of the subject, is given in the *Encyclopædia Britannica* (10th Edition) under the word 'Hypnotism.' The article ends with this passage: "Its successive revivals have been due to the reality of the phenomena, which continually reassert themselves with all the indestructible force of truth: its successive periods of decline have been due to inherent weakness and therapeutic inutility. The hypnotic state and its effects are too uncertain, too capricious and too dangerous for general use in medicine."

have had experience only of an unusually vivid dream, the other have been the victim of an hallucination. On one or other of these grounds we may reasonably reject, or find an explanation for, a perfect swarm of ecclesiastical miracles which draw heavily on our credulity from the earliest date down to the present time.

But if we make these admissions, do we leave ourselves no escape from the conclusion that 'miracles do not happen'? This does not appear to me a necessary consequence; though we must grant that scepticism is generally needful and not seldom justifiable. The more ignorant people are, the more ready are they to believe in, nay to anticipate, miracles from any one who claims the position of a prophet with exceptional authority. The accounts also of marvels are very apt to increase in transmission by amplification and addition, so that the more distant an occurrence from our own age the less likely are we to have got a trustworthy account of it. To what extent these considerations affect the miraculous element in the New Testament, we leave to the next chapter; merely remarking that though the Jews anticipated and even demanded from the Saviour miracles in proof of His claim to have been sent by the Father, these seem to have been held in little value as evidence, and to have produced no lasting impression on those who witnessed them. The Passion week began with 'Hosanna' and ended with 'Crucify Him.'

We must, however, be very careful lest such terms as the natural and the supernatural, lead, as they often do, to a confusion of thought. Again and again these are contrasted in sermons and in writings of an apologetic character as if they expressed things which were contradictory.

That will not be found, at any rate in later years, in the writings of eminent Divines of the English Church (to speak of none other) and it was repudiated, as we have seen, by no less authority than that acute thinker Augustine of Hippo, but it has pervaded much popular theology, both before and since the Reformation. This is largely due to the persistence with which anthropomorphic conceptions still linger in our minds and the difficulty which we find in realizing the omnipresence and the omnipotence of God, that He is even more than immanent in the world—for that phrase strictly construed implies that the two are separate and independent in origin—because in Him not only we, but all things, animate and inanimate, " live and move and have their being." Pantheism in some important respects comes nearer to the truth than that vague and indefinite dualism which contrasts God and His works and regards the universe as an elaborate piece of mechanism which, though once devised by Him, is not adequate or adapted for all possible contingencies, but requires Him to ' interfere,' as an engineer must occasionally do with a complicated machine, either to adjust it or to add some temporary contrivance. We shall come nearer to the truth if we say that in one sense all things, from the most ordinary to those which are without precedent in our experience, are equally natural, for they are all the outcome of Law ; that is, are expressions of the Mind of Him in Whom " can be no variation, neither shadow that is cast by turning," [1] while in another sense everything is supernatural, because, though we can follow up long sequences of phenomena, can understand their relations, can pass by analysis from the complex to

[1] Epis. St. James i. 17.

the simple, we come at last to the cloud of impenetrable mystery, and begin to realize the significance of that phrase in the Book of Exodus, " Man shall not see Me and live."

Thus the measure of miracle is really the extent of human knowledge in the place and time at which it occurred. Caution, therefore, is needed—though this seems often to be forgotten—in making use of the argument ' contrary to experience.' Time was when the most ordinary properties of the magnet were ' miraculous,' [1] now it is used for many purposes, from a child's toy to the mariner's compass. Yet no one can explain why it is that if we apply a magnet to some powdered hematite it has no effect, but if we do the same to magnetite, it brings away a tuft of the little grains. Both are compounds of iron (which also is insensible under ordinary circumstances) with oxygen, yet the addition of a non-magnetic molecule, consisting of one atom of iron and one of oxygen, converts the non-magnetic molecule Fe_2O_3 into the magnetic molecule Fe_3O_4. For centuries, only the most simple and elementary properties of electricity were known ; the word was coined under one great Eng-

[1] Augustine, *De Civitate Dei*, xxi. 4, says : " We know that the loadstone has a wonderful power of attracting iron. When I first saw it I was thunderstruck, for I saw an iron ring attracted and suspended by the stone ; and then, as if it had communicated its own property to the iron it attracted, and had made it a substance like itself, this ring was put near another, and lifted it up." . . . Then he goes on to relate what a ' brother in the Episcopate ' had related to him—that he saw a former count of Africa, Bathanarius, put a bit of iron on a silver plate, under which he held a magnet, moving it about. " The intervening silver was not affected at all, but precisely as the magnet was moved backwards and forwards below it, no matter how quickly, so was the iron attracted above."

lish Queen as the science, appropriately enough, grew up under another. Since her accession its developments have been enormous. We conjure it out of our rivers and waterfalls and set it to work our factories, even our trains and vehicles, and light our streets and houses, with a host of other duties. Yet seventy years ago these things would have been regarded by the multitude as the dream of a visionary. We employ it to carry messages over the land and under the sea, so that it 'puts a girdle about the earth' in much 'less than forty minutes,' and we even make it transmit spoken words from places miles away. Yet the electric telegraph, though the possibility was more than once predicted, did not come into being till 1837; telephony was attempted in 1860, and only became fairly successful in 1876. Now the housekeeper orders the day's stores from the tradesmen, or the master, from the same house, sends instructions to his office or his works, two miles or more away; the doctor hears at breakfast time how a distant patient has passed the night; we turn the electric light on or off in our houses, and get into an electrically propelled vehicle, without ever thinking that we are doing something which would have been counted as a miracle in the days of Julius Cæsar, and perhaps even so late as those of George III. Greatest marvel of all, we can transmit messages, without any connecting wires, across distances which, almost every month, become wider and wider. Yet I well remember, when first the feasability of wireless telegraphy was being seriously debated, a friend, well qualified to express an opinion, saying to me, not twenty-five years ago, that he doubted whether hill ranges and the curvature of the earth, when places were long distances apart, would not be insuperable

obstacles. Nevertheless, though we have impressed this marvellous force into our service, we do not know its real cause or why it can stand in certain relations to particular forms of matter, any more than we know these things in regard to matter itself, to light, and to life. Notwithstanding the immense progress that has been made in the memory of octogenarians, the most successful of those who have been leaders in discovery will frankly admit that clouds still hide from their view the mysteries of becoming, so that even these familiar experiences are in their origin miraculous.

But these are not nearly all the marvels which have become familiar incidents to men still living. For instance, if a very small pellet of lead, only a thousandth part by weight, be dropped into a crucible of molten gold, the alloy when cooled, though apparently unchanged, is no longer flexible but brittle. Into a crucible of melting iron drop the same proportion of alumina and the pasty mass will become as fluid as water. If a very little phosphorus be added to melted iron, the metal, when cooled, will be made harder and more brittle; with a slightly larger proportion, it will be softened, but with a little more it is again hardened. These things, though they exhibit a coincidence with a certain law in Chemistry, still remain inexplicable. Again, 'photography in the dark' would seem a contradiction in terms, yet, not many years ago, Dr. W. J. Russell demonstrated that certain familiar hydrocarbons affected a sensitized plate when all light was excluded. The Röntgen rays, mentioned in an earlier chapter, accomplished results which, according to the ordinary use of the term, were miraculous, and the phenomena of radium were even more startling and contrary

to the laws of nature, as then known.[1] But it is hardly necessary to enlarge further upon this subject, for it has been admitted, and that by one who is no friendly critic, that even in regard to the Gospels " physical science is wholly incompetent to furnish demonstrative evidence that any statement made in these histories is untrue. Indeed modern physiology can find parallels in nature for events of apparently the most eminently supernatural kind recounted in some of those histories.[2]

Lastly, we must remember that if we admit the possibility of any revelation we also admit that miracles, as we call them, though they may be improbable, cannot be summarily rejected as impossible. They may be like the sudden flaring up of a star, things which, though they occur but rarely, do sometimes happen. Hence they demand consideration. But if we refuse to make that admission, then, so far as I can see, we limit our knowledge to the things which can be discovered by our senses, that is, by careful observation of phenomena and by inductive reasoning from them. The latter perhaps, at a later stage, may be extended by deductive methods, but their results will require, from time to time, to be tested by experiment. The effect will be that we shall ultimately be driven to accept the present life as a lottery where the blanks are more numerous than the prizes, and to abandon the hope of anything whatever after it has come to an end. This is a depressing conclusion, but I do not see how to escape it, if we deny the possibility of a revelation, which is in itself a ' miraculous ' event.

[1] P. 16 *et seq.* [2] T. H. Huxley, *Nineteenth Century*, xxv., p. 189.

CHAPTER VI

THE CREDIBILITY OF CHRISTIANITY

JUDAISM and Christianity have this in common, which distinguishes them from other religions antecedent in date to the latter, that they claim to be founded on direct revelations from God, and thus to have a supra-natural source for their knowledge of the unseen. An element of miracle accordingly enters into both religions, but in Christianity this presents an aspect more distinctly doctrinal than in Judaism. In the latter the miracles were manifestations of the power of Jehovah and of His mercies towards His chosen people, proving that there was no other God like Him, for none could do such mighty works as He had wrought for them. But this is not a proof of monotheism, nor does the language of the Old Testament in all cases distinctly assert it. The Jews did not claim a monopoly in miracles. There was, in almost all creeds, however rudimentary in character and debased by superstitions, an expectation of 'signs and wonders.' The religions of Greece and Rome are full of stories of such events. The great trial on Carmel, between Elijah and the prophets of Baal, at which, after each side had called upon the name of his God, the one that answered by fire should be the nation's God, was obviously regarded as a reasonable challenge. The people, 'halting between two opinions,' believed

either Deity to be capable of working a miracle, and the result did not necessarily demonstrate more than that, at any rate in the land of Jehovah, Baal was powerless.

But in later days, as we have indicated, the creed of the Jews became a definite monotheism, and from it Christianity is an offshoot. Thus the former is the history of a nation, but in the latter the Incarnation is its fundamental doctrine ; the one is the account of how God worked by man for men ; the other of how God worked as Man among men. The Incarnation is not an instructive allegory, like *Pilgrim's Progress*, but claims to be, from the Annunciation to the Ascension, a narrative, the main incidents of which are truthfully reported and really did happen. Hence we have no choice, if we believe this, but to admit that the life of Jesus Christ is an event unique in history. We must therefore consider, in more detail than was necessary for Judaism, how far its claims for acceptance are valid.

It may be well, before discussing particular objections, briefly to notice three of a more general character, and on the whole less modern. One of them amounts to this, that Christianity involves the belief that " the Unlimited Cause ' took the disguise of a man for covenanting with a shepherd chief in Syria ' [1] [and of course, at a later date, with many other persons in that region]. I do not indeed admit that this sentence accurately expresses the fact, but letting that pass, I feel inclined to compliment the critic on his capacity for prescribing to the Infinite His modes of operation. The saying is thoroughly man-like. It is the outcome of a spirit like that which makes small people arrogant with those whom they consider to be

[1] Herbert Spencer, *Ecclesiastical Institutions*, § 588.

socially their inferiors, and leads men to regard with contempt all else that lives on this our globe. 'What God hath cleansed, that call not thou common' we might justly retort." [1]

A second objection is that: "The Infinite Energy, when revealed under the human form, ascribed to Himself limited knowledge and exhibited a defective moral sense. As already said, I do not expect that the personality—or supposed personality—of the messenger would be lost by absorption; nor can I believe that the message would have been of much use if it had been made to conform to the intellectual requirements and moral status (which may be a fallible status) of the [twentieth] century after Christ."

The third objection is this: "That if the Christian religion is not of like origin and development with others, it must follow that 'a complete simulation of the natural by the supernatural has been deliberately devised to deceive those who examine critically that which they have been taught: appearances have been arranged for the purpose of misleading sincere inquirers that they may be eternally damned for seeking the truth.'" [2] This charge must receive some further notice in the next chapter; at present it will suffice to say that though the words of many Christians and of certain Churches give some colour to the assumption involved in this statement, I consider the noose, into which it is supposed to lead me, to be only a phantom, since I find no valid foundation for it in the

[1] The author, *Old Truths in Modern Lights*, pp. 47–49. These words were written more than twenty years ago, and I have not learnt anything since then which has caused me to alter the opinions expressed in the quotations.

[2] *Ecclesiastical Institutions*, § 588, conclusion.

authorized formulas of my own church, and still less in its charter, the sayings of Christ and His Apostles.

We pass on to the more particular objections which have been brought against the history itself, but before entering upon them perhaps should notice one fact which adds something, though it may not be much, to the credibility of the Gospel narrative. It is the widespread expectation about nineteen centuries ago—not limited to the Messianic hope of Judaism—that a great leader would arise. Traces of it may, perhaps, be found in the Fifth Eclogue of Vergil; it is distinctly mentioned and connected with Judæa by Tacitus, and its wide extension is vouched for by Suetonius in the words so often quoted.[1]

We proceed then to the points on which objections may be raised against the historical accuracy and authority of the New Testament. It is a collection of documents by various authors and of rather different dates. We must therefore be prepared to show, in the first place, that these remain as they were originally written, without material change by alterations, interpolations and additions. It would, of course, be unreasonable to expect that any very ancient book should now be in exactly the same condition as when it left the author's hands; allowance must be made for small errors, which are almost inevitable in copying manuscripts and which have a tendency to multiply, as the process is repeated, because they are less easily detected than in the revision of a proof-sheet. Such are sure to creep into the text, but

[1] The original is '*Percrebuerat oriente toto vetus et constans opinio, esse in fatis, ut eo tempore Judæa profecti rerum potirentur* (Vespasian, c. 4). Tacitus was born about fifteen years before the reign of Vespasian, Suetonius about the beginning of it (69 A.D.).

if these are neither more numerous nor important than is usual in any other work of ancient date, we may feel reasonably certain that it remains in all important respects as it was originally written. Three lines of evidence converge to this conclusion in the case of the New Testament ; namely, ancient manuscripts of the Greek original ; ancient translations into other languages than Greek, and quotations by ancient authors. The first is, of course, the most important ; the second do not tell us the original words but the meaning attached to them by the translators ; the third are merely fragments, which often represent but a small part of the whole, and may not always be exact transcripts of that, for they may have been quoted from memory and thus be liable to small errors.

As another volume in this series will deal with the results of investigations in these directions, it will suffice to give in this one a brief sketch of the main facts in each case. The oldest manuscript of the Scriptures[1]—that in the Vatican library—is assigned by competent authorities to the middle of the fourth century. From it one group of Greek manuscripts appears to be derived, but another suggests a different parentage. The Vatican text is believed to have the authority of the great Alexandrian Scholar, Origen,[2] but the other group of manuscripts cannot be followed back to beyond the end of the third century,[3] so that their source is a little less ancient,

[1] Commonly quoted as Codex B. Some consider the Codex Sinaiticus to be at least as ancient, but rather less authoritative. Codex Alexandrinus (A) is assigned to the second half of the sixth century. Codex Ephremi (C), a palimpsest, in an imperfect condition, is supposed to be of much the same age. (See Adolf Jülicher, *Introduction to the New Testament*, pt. iii., ch. ii., § 52.)

[2] Died A.D. 253.

[3] F. C. Burkitt, *Two Lectures on the Gospels* (1901), p. 11.

but not necessarily less valuable, than the other one. But the existence of these distinct groups of minor variations justifies the assumption that the manuscripts characterized by them must be the descendants of originals considerably more ancient. It is therefore highly probable that the text of the New Testament has come down to us in no worse condition than that of one of the great classic authors between the ages of Pericles and of Hadrian.

Two translations are older than the Diocletian persecution (A.D. 303). The one, the Codex Bobiensis, in Latin, "preserves for us the text as used in Roman Africa about the time of St. Cyprian, i.e., in the middle of the third century"; [1] the other, in Syriac, represents the form of the Gospel history which was accepted among Syrian Christians before the end of the second century,[2] and both these accord with that of our New Testament.

Direct quotations from the writings which it contains are, as might be expected, few and uncertain till the later half of the second century, but the earlier Patristic writings indicate the existence of a history, which corresponded, in its main points, with that now in our hands.

A few passages in the latter may be later interpolations, though not on that account necessarily unworthy of credit, but the four Gospels must have been accepted,

[1] F. C. Burkitt, *Idem*, p. 12.

[2] For the history of the recovery of this work and of its author, see J. H. Hill, *The Earliest Life of Christ* (1894) and J. M. Fuller, art. *Tatian, Murray's Dictionary of Christian Biography* (Wace and Piercy, 1911). Tatian was converted about the middle of the second century by Justin, who is believed to have suffered martyrdom about 165 A.D. In his writings he repeatedly asserts the Virgin Birth, the Crucifixion, the Resurrection and the Ascension. See, for example, *Apology* I (written about 148 A.D.), c. xxii., xxxii.–xxxiv., xlvi. *Dialogue*, c. xliii., lxvi.

practically in their present form, before the middle of the second century. This is shown by the Diatessaron of Tatian, a harmony of these gospels, which was compiled for the use of Syrian Christians in the later part of that author's life, which ended, probably at Edessa, about 180 A.D.

But though we can show that the Gospel story was current and accepted by Christians well before the middle of the second century, it is important to ascertain, if possible, the dates when it crystallized, so to say, in written documents, because if it had existed as merely oral tradition for perhaps seventy or eighty years after the Crucifixion, there might have been time for many legendary accretions, which would represent in the Christ of the second century a very different person from the true Jesus of Nazareth.

That position was adopted by D. F. Strauss, author of the noted *Leben Jesu* (published in 1835), which may be taken as the starting-point, as regards the New Testament, of the so-called Higher Criticism. He held the Gospel history to be a collection of myths which had gradually sprung up among the early Christian communities, and he sought by analyzing the details in each separate story to detect the kernel of historical truth, where it existed. By this process it was deprived of any miraculous or prophetic character and " the Christ of faith was reduced to a mere group of ideas." As the School of Strauss still finds active representatives, it is most important to ascertain, if possible, at what dates the Gospels and other documents in the New Testament, which incorporate historical details, were written down in their present form. Though it is true that legends soon cluster around

the memory of any personage who has caught the popular fancy,[1] such a complete envelopment of an exiguous historic stem by a parasitic legendary growth, as Strauss imagined, would require much more than a single generation. In the infancy of the Church, instruction, no doubt, would be mainly oral; anything written down would be as a memorandum for personal use, or as a passing reference to some incident in a letter. The drawing up of connected narratives would not begin till those who had been eye-witnesses of the events were becoming few, and communities were growing up at distances which made it difficult for them to keep in touch with the original centre. It is therefore quite possible that the author of any one of the Gospels may have made use of older (and generally shorter) documents, as St. Luke states that he did. Papias, Bishop of Hierapolis, writing about 130 A.D.,[2] uses words which imply that a Gospel attributed to St. Matthew already existed, though it may have consisted mainly of the Lord's discourses and have been written in Hebrew. On this question authorities differ, but Papias goes on to say that Mark, who had not himself been a follower of the Lord, became the interpreter of Peter, setting down what he remembered of that Apostle's teaching, but without the design of writing a connected history.[3] St. Luke states that other documents existed when he wrote his Gospel. It is therefore clear, that the synoptic gospels may be, to a certain extent, compilations,

[1] See *St. Thomas of Canterbury*, by E. A. Abbott (1898), vol. i., part ii. (*St. Thomas' Miracles*).

[2] See W. Smith and H. Wace, *Dictionary of Christian Biography*, s.v. "Papias."

[3] See Leighton Pullan in *Murray's Illustrated Bible Dictionary*, s.v. "Gospels."

and scholars have endeavoured to ascertain by careful scrutiny what indications the three synoptic gospels afford of common and of independent elements.

The language differs: all are written in Greek, but in a dialect of this language which shows an Aramaic influence; that of St. Mark's Gospel is the least classical, and is such as would have been spoken by an ordinary Jew in the first century of the present era. St. Luke could write the best Greek of the three, but in places employs strongly Aramaic idioms which suggests that he is quoting from written documents. St. Matthew exhibits a somewhat similar diversity. Of his quotations from the Old Testament, those which also occur in the other two are from the Greek version; those peculiar to himself are nearer to the Hebrew. Again, of the incidents narrated, nearly one half are common to all three gospels, while of the rest St. Matthew has not quite one-seventh in common with St. Mark and the same proportion with St. Luke, while less than one in seventeen occurs in both St. Mark and St. Luke, and parallel passages are often followed by corresponding incidents. But there are also differences, which cannot be explained, except on the assumption that the writers sometimes made use of different authorities. The results of investigations, of which the above mentioned may serve as examples, justify the inference that the evangelists did not rely simply on a common oral tradition, but also used written documents; St. Matthew and St. Luke, writing with the intention of supplementing the account given by St. Mark which probably each of them possessed together with other documents of which he had not known.[1]

[1] See, for a discussion of this question and the relation of the synoptic gospels generally, F. C. Burkitt, *ut supra*, pp. 41–51.

If then we were considering the works of ordinary classic authors, we could not reasonably doubt that the synoptic gospels existed in their present form and were regarded as records of the life of Jesus well before the middle of the second century, and by men, some of whom were born in its second decade, and that the main outlines of them were looked upon as matters of faith a few years after the middle of the first one.

But a closer approximation to the dates of these Gospels can be made. This, for the reasons mentioned above, is difficult in the case of St. Matthew's Gospel, but the tone of it suggests the possibility of its having been written to strengthen the faith of the Christians in Palestine during the troubles which culminated in the capture of Jerusalem (70 A.D.).

St. Mark's Gospel, the most life-like of the four, as it has been called, may very well have been written at Rome, as tradition affirms, after St. Peter and St. Paul had gone there, but previous to the death of the latter, and so probably about 61 A.D.[1]

We can hardly doubt that St. Luke's Gospel was written by the author of the Acts of the Apostles and preceded the latter, the silence of which about the Epistles of St. Paul, and the death of that Apostle and of St. Peter, suggest that it is earlier than 65 A.D. Besides this, the Gospel must be anterior to 70 A.D., unless we hold that clear prophecies about the destruction of Jerusalem prove the Gospel to have been written after that catastrophe—a most disputable assumption. "It is therefore an early work, probably about A.D. 63. . . . It is the most literary of the Gospels, from the pen of a man of education

[1] Leighton Pullan, *ut supra*, s.v. "Mark."

and versed in Greek, the polite language of the Roman Empire " ; [1] phrases in it suggesting that the author was a physician, as we know St. Luke to have been. Thus we are justified in inferring that the history of Christ, related in the Synoptic Gospels, was identical in its main features with that accepted generally in the Church less than forty years after His death.

The age and authority of the Johannine Gospel is a more complex question. Internal evidence shows its author to have been a Jew, and one who had lived in Palestine prior to the destruction of Jerusalem. It must have been well known to Justin Martyr, and was possibly used by Ignatius, Polycarp, and the author of the *Didaché*, which would make it not later than the beginning of the second century. It is generally admitted to have been written after the other three Gospels, " not so much to supplement them as to present the Person of the Lord from another point of view." [2] Theophilus of Antioch, about 182 A.D., expressly ascribes this Gospel to John, and Irenæus, who lived from 131 to 200 A.D., not only shows that four Gospels were then accepted, but also says that this one was written by that Apostle. He was a disciple of Polycarp, who was born 69 A.D., and is distinctly stated to have been a disciple of John the Beloved. Thus it is almost certain that this Gospel existed in the early years of the second century. But its authorship has been disputed, from the days of the Docetæ and Cerinthus to the present time, which is not surprising since it so strongly asserts the union of the Divine and the Human Nature

[1] *Ut supra*, s.v. " Luke."

[2] For a fuller discussion see H. M. Gwatkin, *Murray's Illustrated Bible Dictionary*, s.v. " John, Gospel according to St."

in Christ. Some ascribe it to a 'great unknown,' of whom no other trace can be found; others refuse to believe that a son of Zebedee could have been qualified to be its author; others again maintain that during the Apostle's long life, his remembrance of the real Jesus became transformed, so that the Gospel represents, not what the Master really did say, but what the Apostle thought He ought to have said. The discussion of these views must be left to another volume of this series, with the remark that we may here admit the possibility of the Gospel not being an autographic document. It certainly belongs to the old age of the Apostle and it may have been either dictated to a disciple or compiled, soon after his death, from memoranda written down by the latter.[1]

There is no reason for considering the Acts of the Apostles to be a composite document in the strict sense of the term, though parts of it are distinguished from the rest by the use of the pronoun 'we.' It is attributed to Luke, who was a companion of Paul on some of his missionary journeys, and was written rather later than the Gospel, perhaps about 65 A.D. It gives accounts of the Ascension and the descent of the Holy Ghost on the day of Pentecost, and affords ample proof that the teaching of the Apostle of the Gentiles was founded on a belief in the Divinity and Resurrection of the Saviour, and must have agreed in all such matters with that of the older Apostles.

But we possess in the New Testament at least four other documents which, in all probability, are rather older than any of the Gospels. These are the Epistle to the

[1] For a discussion of these questions see also F. C. Burkitt, *ut supra*, p. 71. According to the point of view the date of the gospel would fall between 85 and 95 A.D.

Romans, that to the Galatians, and the two to the Corinthians, the genuineness of which, as writings of St. Paul, is admitted by all serious critics. These demonstrate his complete severance from the traditional Judaism, which he had once so zealously defended ; his views on justification, the significance of Christ's death and the Lord's Supper ; his intense belief in the Resurrection, and his ideas on the nature of the risen body. They also show indirectly that, though he was not an eye-witness of any incident of the Saviour's life on earth, and may not have been at Jerusalem during the years of His ministry, the story of that life, which the Apostle told in Antioch, in Asia Minor and in Europe, agreed with that taught by the leaders of the Church at Jerusalem, with whom, as he tells us, he had opportunities of conference. The four epistles already named must have been written between the years 50 and 59 A.D., so that St. Paul's teaching about the history of Christ was identical in its most important points with that generally current about twenty years after the Crucifixion—a very short time, if this were not true, for so great a parasitic upgrowth of legend, even if we make every allowance for the peculiarities of the age, the avidity of an Oriental people for the marvellous, and their expectation that the Messiah would be a wonder-worker.

The general difficulties presented by a miracle have been already mentioned,[1] those special to the life of Christ must now be briefly considered. The concession already made renders it needless to discuss these in detail, so after a few general remarks upon the character of the New Testa-

[1] Chapter v.

ment miracles, especially when compared with those alleged to have happened in earlier and later periods, we may pass on to two which, more than all others, are fundamental characteristics of Christianity. The miracles ascribed to Christ are signs and powers rather than prodigies. We cannot remember one which, like some of those related in the Old Testament, is merely a demonstration of the worker's superiority to the ordinary laws of nature. In this respect the New Testament shows a marked difference from the Apocryphal Gospels, in which prodigies abound. In the latter, details are freely supplied to amplify the marvels of the Saviour's earlier days ; angels are constantly appearing and disappearing ; mysterious lights gleam ; wild beasts are tamed ; the idols of Egypt are broken ; children, who play mischievous pranks on Him, schoolmasters who strike Him, are themselves smitten with paralysis or death ; misfits in wood and cloth are set right, and so on with wearisome iteration, till there seems no limit to the credulity of either the writer or his readers. Even the most remarkable instances in the New Testament of the Lord's power to supersede the ordinary laws of nature ; such as the change of water into wine, the feeding of multitudes, the control of the storm, the walking on the water and the withering of the fig-tree, have all a directly ethical significance. With these may be classed the miracles of healing, many of which, as was said above, may seem in the future less abnormal than they do even at the present time, when we are becoming more familiar with phenomena presenting some, though slight, resemblances to them. These, and even others, like those just named, may at that age have been necessary. Let us assume that Jesus, even more

than any of the great prophets of olden time, was a special messenger from God to man. What were to be His credentials ? He was sent to a people, already in expectation of a Messiah, who was to be, as a matter of course, a worker of miracles, and of whom they had formed an ideal which Jesus did not at all fulfil. An objector may say that the moral grandeur and spiritual elevation of His teaching would have amply sufficed as credentials. It has always seemed to me that assertions of this kind do not find much support from history and are peculiarly ' academic ' in character, and I may add that, even in circles to which that epithet applies, I have not myself found any remarkable or very general readiness to consider the message itself rather than the messenger and His supposed proclivities, whether political or religious.

Had there been nothing else to commend the teaching of Jesus, on the one hand, to the Scribes and Pharisees, and, on the other, to the ignorant populace, I cannot but think that He would have seemed a ' vain babbler,' as his follower Paul did to the philosophers of Athens. More than once, as it seems to me He expresses some repugnance to the necessity for compliance with this demand.[1]

If there is any meaning at all in the theological term Incarnation, that is, if Christ were something more than ' one of those tall columns which from time to time rise above the dead level of humanity,' [2] or even if the power of God dwelt in Him far more abundantly than in any one of the ancient prophets, His relation to the world in which He was living would be quite different from theirs. This may be made clearer by an illustration, though a rough one. When an electro-magnet is disconnected from the

[1] John iv. 48. [2] Renan, *Vie de Jésu* (1864), p. 457.

battery, it is incapable of holding up a bar of iron—that falls at once in consequence of gravitation. But if the current is switched on, the bar adheres to the magnetized arm and remains suspended as long as that is passing. The power exerted produces a result which, to one who could not see how it was done and was quite ignorant of electricity, is a miracle. It is noteworthy that Christ is said on one occasion to have been conscious that power (δύναμις) had passed out from Him,[1] and that in some difficult cases the power delegated to His followers proved to be inadequate. The current was too weak for that purpose. Thus, if we believe that Christ was God and man, whether we accept the statements in regard to that union which are given in the so-called Athanasian Creed, or incline to those held by Arians, Nestorians, Eutychians, or any other unorthodox body, and if we believe that all the phenomena of nature are manifestations of the power of God, it would, I think, be more surprising if He had never given any signs of standing to those phenomena in a relation not altogether identical with that of ordinary men ; or, in other words, a refusal to believe that He could and did work ' miracles ' seems to imply a denial of His divinity.

At the same time it is possible to admit, as a general proposition, that Christ possessed this power, and yet to dispute the statements about two episodes in His life, which have for long been considered to be of fundamental importance in Christianity—the Virgin Birth and the Resurrection.

In regard to these we cannot, obviously, obtain the same kind of evidence. The one could not be capable of

[1] Mark v. 30, Luke viii. 46.

verification to the same extent as the other. The fact of Christ's birth would be known to many, but not the special circumstances which distinguished it from all other births. Of these circumstances only a very few persons would be cognisant. As the Virgin Birth was a thing difficult to prove and very liable to misrepresentation, we should expect it to be brought into prominence only as a matter of necessity; that probably being the springing up of controversies on the relation of the divine and human elements in the Person of Christ. With that subject it has a more intimate connexion than may at first sight be apparent, so that probably for this reason, but certainly because, as is also the case with the resurrection, it cannot be explained away, like the so-called miracles of healing, as an exaggeration of an ordinary fact, or a misunderstanding of a process, but must be either true or false, it has been much exposed to the assaults of critics.

Though it would carry us rather beyond the limits assigned to this volume if we entered upon a full discussion of some recent attempts [1] to show that St. Paul did not know of the Virgin Birth, we feel bound to remark that the arguments in favour of this view, when judged by the ordinary methods of inductive reasoning, do not seem to be convincing. We cannot admit that his silence, when writing to Gentile converts on topics with which this doctrine is not directly concerned, justifies us in inferring ignorance on his part. If he had believed that "Jesus was born of human parentage," he must have held and taught some form of the opinion afterwards maintained by Nestorius, "that Christ consisted of two distinct persons; one person the Son of God; the other

[1] E.g., J. M. Thompson, *Miracles in the New Testament*, ch. ix.

person, that human being which had been conceived " in the ordinary way ; for if a human being had been first conceived " and then united to God . . . that human being must have been a human *person,* previously to the union with the Divine Person ; and so the Incarnation would have been the union of two persons, not of two natures " ; [1] a proposition which was a fruitful source of controversy in the earlier ages of the Church, and of which an aspect, indirectly raised by modern science, must presently be considered.

The attempts also to argue from the silence of St. Mark's Gospel and of the Acts of the Apostles, to discredit the mention of the Virgin Birth in the other two synoptics, and to maintain that the fourth Gospel " ignores, if it does not reject," that doctrine, often seems to be so far-fetched as to be very improbable. We are therefore unable to agree with the author already quoted,[2] in declaring the conclusion of the whole survey of the authorities to be " that the positive evidence for the fact of a miraculous birth must be pronounced to be exceedingly weak. The negative evidence—i.e., the evidence for the existence of views which ignore, exclude, or supplant the Virgin Birth—is very strong."

As regards the former assertion, its acceptance or rejection must greatly depend upon the mental habits of the person who considers it and the methods of expression which he expects from ancient chroniclers, but in regard to the latter we submit that it has no better support than the fact that these authors either do not go out of their

[1] E. H. Browne, *An Exposition of the Thirty-nine Articles,* art. ii., § 2.

[2] *Ut supra,* p. 159.

way to make a proclamation of this mystery or they repeat phrases in popular use without thinking it necessary to insert a correction of them. Is it not rather unreasonable to require that plain men, as a rule without literary training, should express themselves with the precision of a legal document or a mathematical demonstration ?

One aspect of this disposition to expunge from the Apostles' and the Nicene Creed the article about the Virgin Birth, perhaps has not received the consideration it deserves from a point of view which borders on the scientific. If the modern revival of the Ebionite idea be correct, and Jesus was only an ordinary man until a very special change was wrought in Him at some epoch in His life—say His Baptism :—then His Divine Sonship cannot have meant anything more than a special gift of the Spirit of God, differing perhaps in degree, but not in kind, from that bestowed on the Apostles at Pentecost. Since we do not find, as we might have expected, the slightest information about the time when this gift was conferred—whether in infancy, boyhood, or early manhood, and St. Luke's words even imply a gradual and normal progress during the second and the third—we must accept either the hypothesis just mentioned or that which has hitherto been preferred by the Church. The difficulties associated with the latter are obviously very great, but they have certainly not been increased by any recent progress of science. Parthenogenesis is not a unique occurrence in the order of nature, though it is restricted to the invertebrata, and among them till recently to rather low forms. In these cases some explanation of it can be offered, but it shows, at any rate, the possibility

of the production of an offspring without the usual synthesis of the sexes ; and a more significant statement has recently been made that in the process of sexual reproduction, the researches of J. Loeb and others upon the ova of the sea-urchin have proved that we can start the process of division of the ovum and the resulting formation of cells, and ultimately bring about the development of the whole body—if a simple chemical reagent is substituted for the male element in the process of fertilization. Indeed, even a mechanical or electrical stimulus may suffice to start development.[1] If this be so, if a result, which is generally regarded as a phenomenon essentially vital, can be brought about by either of the latter means, and especially the second one, which, as we have already said, seems to be a force that might be called creative, then the words ascribed to the Angel Gabriel acquire a still wider significance : " The Holy Ghost shall come upon thee, and the power of the Most High shall overshadow thee : wherefore also that which is to be born shall be called holy, the Son of God.[2]

Any form of the Ebionite hypothesis introduces difficulties which, though less obvious, are no less serious than those in the other one. Writers in the New Testament declare that Christ differed from all other men in being altogether without sin.[3] If, then, He were born by the same process as the rest of mankind, we seem to be compelled either to maintain (with our forefathers) that man was the result of a special creative act, or that

[1] E. A. Schäfer, *Presidential Address to British Association*, 1912, pp. 9–10. For the full quotation see page 83.

[2] Luke i. 35.

[3] 2 Cor. v. 21 ; Heb. iv. 15 ; 1 Pet. ii. 22. Cf. Articles of Religion, No. xv.

he could be sinless, though he had derived his body (σῶμα) and life (ψυχή) from an animal ancestry. At the present day, probably no one who had made a serious study of science would defend this first proposition, so that the latter only is left for consideration. If it were true, would sinlessness be possible? We may venture to assert—for it is in accordance with all experience—that in the earlier days of life the animal nature in man or woman develops more rapidly than the spiritual, so that a little child, for the first three or four years of its age is hardly more than a young animal, generally, but not always, docile. Disobedience, resistance to authority, yielding to temptation—whatever things are done with the knowledge that they ought not to be done—however occasional such acts may be, are of the nature of sin, and we may boldly ask whether there ever was or could be a human being so constituted as never to have found that the σῶμα and ψυχή had, by their rather more rapid development, succeeded in worsting the πνεῦμα, which more slowly attains to its full vigour. Every human being, born after the flesh, is a battlefield between opposing natures, the animal and the spiritual, so that any being, who had reached the age of thirty without having committed sins, though these might be small, would not be a man or a woman but an apterous angel. The Anglican Church declares that, even after regeneration, "the lust of the flesh, called in the Greek φρόνημα σαρκός, which some do expound the wisdom, some sensuality, some the affection, some the desire, of the flesh, is not subject to the Law of God." [1] If so, absolute sinlessness is impossible, and if it be not, some Christian doctrines

[1] Articles of Religion '*Of Original or Birth-sin*,' No. ix.

of cardinal importance would have to be not restated but recast.

We may find some light thrown on this question, the discussion of which involves certain difficulties, if we remember that, even though the Genesis account of the Fall of Man may be an allegory, the first piece of knowledge acquired by the erring pair was that they were naked. Of that also a little child is still for a time unconscious; but when once this knowledge has been acquired, it is too often apt, so soon as the body begins to develop, to prove one of the deadliest of poisons. To repudiate the doctrine of the Incarnation, as usually held by the Christian Church, though by no means a novelty, seems to involve a denial that the Offering for sin was Himself without sin.

Methods similar to the above-named are adopted also in dealing with the Resurrection. If a passage in the New Testament is inconvenient, it is dismissed as an interpolation, while silence about an incident is taken to imply ignorance of it. For want of space it is impossible to discuss in detail the minute criticisms which are intended to undermine the ordinary belief in the Resurrection of the Saviour, but we may take as an example the "women's story of the empty tomb on the morning of the third day after the crucifixion." Of this, we are told, it is hardly possible that Paul could have known, and yet made "no reference to it in the preceding passage" [1] (1 Cor. xv. 3–8). But why should he have referred to it? He was writing to the Corinthians to remind them of the instruction which he had given them about the death and resurrection of Christ, and to impress

[1] J. M. Thompson, *ut supra*, pp. 165, 172.

upon them the fundamental importance of the latter event. In regard to that, the empty tomb, by itself, proved but little. The body might have been removed more or less secretly. Appearances of the Lord, and that not as a mere phantom, were the only direct evidence of His resurrection.[1] Moreover, in regard to these, it was not necessary that Paul's list should be complete. He was writing, not a formal history of the life of Christ, but a letter, mainly about discipline and conduct, to persons among whom he had lived and taught for eighteen months. It was enough for him to remind them of the main facts, and then to emphasize the close connexion between the resurrection of Christ and the believer's assurance of immortality in a body which was celestial rather than terrestrial. That he had an intense belief in the former event can hardly be denied, and if so, his teaching in regard to historical matters cannot really have differed, as we have endeavoured to show,[2] from that of the eye-witnesses at Jerusalem. Hence we are unable to discover, in the elaborate mixture of microscopic criticisms and dubious hypotheses, any valid ground for concluding that Paul believed in the Resurrection without believing in the empty tomb ;[3] we fail to

[1] One attempt to harmonize the Gospel records with an *à priori* assumption—that the Roman guard by the Cross and those who placed the Body of Christ in the tomb were mistaken in supposing Him to be dead ; that He revived after a prolonged swoon ; in some way or other left the sepulchre and then occasionally visited His disciples—seems inadmissible on scientific grounds, unless we suppose the accounts of these interviews to be grossly exaggerated. Would it be possible for One Who had hung on the cross for some hours on the Friday to have walked to Emmaus on the following Sunday afternoon ? This hypothesis seems to be postulating one miracle in order to discredit another. [2] P. 155. [3] J. M. Thompson, *ut supra*, p. 172.

see what he would have gained by any such conviction, for it would have been no more than one of a personal immortality and in the appearance of ghosts. The Scribes and Pharisees had already got as far as that, and so, we may presume, had the Lord's disciples before He called them. What, then, had occurred, which was so exceptional in its character as to effect such a transformation in them, to change timidity into courage, hopelessness into an assurance of victory? Unless we start with the postulate that "miracles do not happen," the story in the New Testament, notwithstanding some discrepancies on points of detail, seems to afford a more probable explanation than vague assumptions, such as that the angel seen in the sepulchre by the women was some unknown young man, that their story is a late addition to the narrative, and that St. Paul's use of the analogy of the seed and the future plant only shows his ignorance of botany. In regard to this we venture to recall a suggestion which has apparently been overlooked —that there is a continuity of life between the seed and the future plant, though the great bulk of the former has practically perished, and that one, in some respects similar, is possible between the present and the resurrection body. The essential link between the two, or any number of states of embodied existence, is a continuity of consciousness. It is the knowledge that 'I am I' which constitutes personal identity. How the continuity is to be maintained after the death of the body, or whether consciousness continues without any break, are questions not easily answered. On this point very little has been revealed and nothing can be discovered: but such inferences as can be drawn from the Scriptures

seem to justify giving an affirmative answer to the latter question. But if this be so, consciousness obviously cannot be separated from life. It is practically impossible for us to conceive of life, or at any rate of an individual life, existing apart from a physical basis in the order of which our senses are directly cognisant. The first essential of a personal consciousness is the recognition that a difference exists between that which is of me and that which is not of me—between the 'I' and the 'not I.' But this distinction implies a consciousness of boundary and limit; more than this is not necessary for the constitution of a corporeality. It is quite true that we generally attach ideas of cohesion and solidity, more or less, to the word 'body,' but these can hardly be regarded as essential. All that is really requisite is a consciousness of possession, a consciousness of boundary. Even in the present body we admit that the cohesion of its constituents is only a temporary one, which is daily being altered and will ultimately be dissolved; if so, the magnitude of the time unit is surely a question of secondary importance; the life of an ephemeral insect may be as complete in its sensations as that of a creature which endures for a century. Nor are these sensations, unless I am making a mistake, affected by the physical condition of the body. Sensation, with ourselves, is associated with certain stages of imperfect solidity in the material of the organism. But since the vibrations of light can pass alike through a sheet of glass and through the atmosphere, they might be regarded as affecting the one or the other in a very similar way, if we suppose for a moment a portion of each to be isolated from the rest, to be endowed, like ourselves, with sensation and

reason, and to be capable of seeing ; in such a case no serious difference would arise from the solid condition of the one or the gaseous condition of the other. Thus, I find no insuperable difficulty in conceiving sensation to exist in an aggregate of matter, whatever be its physical state. If then, on any ground, I believe in what is commonly called the immortality of the soul, and if, on scientific grounds, I am unable to conceive of the existence of life apart from a physical basis, these two force me to suppose that some kind of a body, invisible though it may be to mortal eye, survives the destruction of the present body, which, like the germ in the seed, constitutes a link between that which hath been and that which shall be. Is it not a suggestive fact that, in all matter of which we are cognisant, the physical condition is a question not so much of its nature as of its environment ? If, then, we grant that some part of the bodily frame be perishable, there is no *à priori* reason why another part may not depend for its physical condition upon its environment, and a great alteration in the one be the result of a great alteration in the other. This, at any rate, is certain that the body which shall be must differ greatly from that which we are now occupying. In the eternal world there will be neither waste to repair nor destruction to arrest ; most, in a sense all, of the present organization will be useless and superfluous, and is not likely to reappear. But on this point it is idle to speculate. What we shall be, we know not. It is enough to be assured that, in the better land, there will be no more weariness, but the delight of work which is not labour ; no more pain, but the joy of perfect life ; no

more sorrow, but the bliss of unbroken peace and eternal love.[1]

The change, which St. Paul expected would occur in the bodies of those who were alive at the second coming of the Lord, may have taken place in His body no less instantaneously. The grosser part of that (σῶμα ψυχικὸν) in which He died and was buried may have been resolved into the elements not less completely than the bodies of those who died ages before His first coming, and that in which He rose—the spiritual body (σῶμα πνευματικὸν)—may have been such a one as I have described, capable of being adapted at will to the environment, and thus no longer subject to the laws by which our bodies are at present governed.[2]

If we accept, as a basis for argument, the statements which are made in the New Testament about the Body of the Saviour after His resurrection, we seem to be entitled to infer (1) that a change had occurred in it owing to which He was not so readily recognized as He had been before His death on Calvary; (2) that the body could materialize (to use a modern phrase) and dematerialize at His will, and that this property must also be extended to His garments; for I suppose

[1] These opinions were expressed by the author at greater length in *Christian Doctrines and Modern Thought*, pp. 115–122 (published 1892).

[2] Paul's phrases in writing to the Corinthians (2 Cor. v. 2; 1 Cor. xv. 35–55) seem to me a slender foundation for the assumption that "at the moment of death, even before death, the new body is waiting for us, ready-made in heaven," or that "by the living, at the appearance of Christ, it will be put on as a garment over the old body, which still survives." We are to be changed, as I read the Apostle's words, not to be disguised in a new vestment.

we may assume that He did not appear to Mary Magdalene, to the travellers on the Emmaus road, or to the disciples, almost or quite without clothing. He could vanish from sight when seated at table, could appear in a chamber, the doors of which were shut, and yet could be touched. We are also told that in order to satisfy the doubts of those who saw Him, He asked for food and ate it in their presence. We cannot suppose that, on this occasion, the process of eating with its consequences, was similar to that by which the body, prior to the crucifixion, had been nourished. I do not so much as hint at anything like a conjurer's trick, but must point out that unless we suppose that food to have been resolved at once into its intangible elements we should be driven to admitting that the ordinary processes of assimilation went on in the resurrection body. The relations of that body to the present environment must have been altogether different from those which had previously existed; and I may take the opportunity of observing, though it does not bear directly on the present subject, that this part of the sacred history may throw some light on a question, which often causes perplexity—that of recognition in the world to come. Suppose a married couple to have been parted by death while both are comparatively young and the survivor to die at an advanced age, how is that one to be recognized by the other; or the child, which has been taken away when its parents were in their prime, to know them when they also, after thirty years or more, cross the dark river to the 'land of the leal.' It is of course possible that recognition may be a consequence of some other attribute than those dependent upon the sense of sight,

but is it not equally possible that the appearance which one embodied spirit presents to another in the life to come may often be subjective rather than objective, so that the same person may wear a different aspect to different individuals? Parents may seem young to the child whom they lost in the earlier years of their married life, and old to those who, some forty years later, had been the solace of their age. I do not, of course, assume that the feebleness of childhood or the decrepitude of old age, any more than deformities or mutilations, will pass the grave, and yet in this case also the saying may come true that we shall know even as we are known.

That in the story of the Resurrection there are some discrepancies and certain difficulties in making out a perfect sequence of incidents, cannot be denied. But these are not surprising, unless we adopt the old notion of 'verbal inspiration' (to which we must refer more fully in the next chapter); indeed, they are almost to be expected. At the present day, accounts of any event which has strongly moved the feelings of the witnesses almost never agree in all details, even when they are given by truthful and generally accurate men. Those persons who have written out their recollection of any moving incident by flood or field, whether as spectators or actors, will find that unless they have taken full notes at the time, it is difficult to trust the memory as to every detail and the order of its occurrence. Indeed, we may venture to assert that the more our feelings are aroused, the more difficult it is to be accurate about the less important matters; the one surging emotion makes it almost impossible to pay attention to these, and in a rapid succession of impressions those first received are blurred,

much as happens with successive exposures of the same photographic plate.[1]

Perfectly accordant narration of such an event as the Resurrection would almost excite our suspicions, for this would suggest, either that they were merely copies of a single document and so did not corroborate one another, or that their authors had carefully compared their stories so that they might baffle a cross-examiner. We must also remember that nineteen centuries ago, though memories were better than they are at the present day, narrators set a lower value on minute accuracy in details than is now the case at any rate in academic circles ; their statements also were more likely to undergo slight subsequent variation because they could not be stereotyped in print and even manuscripts were rare ; so that

[1] A notable instance of this inevitable variation in details is of comparatively recent date. At the Oxford meeting of the British Association in 1860, Bishop Samuel Wilberforce (as mentioned in the next chapter), attacked Darwin's *Origin of Species* in an eloquent speech. Of course he had no first-hand knowledge of the subject, but had been " crammed up to the throat " ; and he sarcastically enquired of Huxley, who took the lead in its defence, whether he was descended from an ape by his grandfather or his grandmother ? Huxley replied to this, in effect, that he would be less ashamed of having an ape for his grandfather than of ancestry from a man who sought to obscure questions with which he had no real acquaintance by aimless rhetoric, by eloquent digressions and appeals to religious prejudice. " The retort," as one who heard it wrote, was " so justly deserved and so inimitable in manner, that no one present can ever forget the impression that it made." Yet there are at least four versions of this incident in print, from first hand evidence, and they differ as to the exact words of Huxley's retort. This, as one of these witnesses remarks, so thrilled the audience as to render impossible a precise verbal remembrance. Critics of a certain school, when they have done with the New Testament, should take in hand the Life of Charles Darwin.

it is unfair to expect from Jews of the first century an observance of the standards with which twentieth century workers in literature or science are expected to comply. We cannot then admit the following conclusion in regard to the evidence : " For the reality of certain appearances of Christ to His disciples, it is very strong. For the emptiness of the tomb on Easter Day, i.e., not for the women's story, but for the fact which that is intended to establish, it is insufficient. The evidence is complicated by the old tendency to confuse history with apologetic. The women's experience becomes a vision of angels, and their message a demonstration of the empty tomb." [1] But, unless the tomb were empty, there would be nothing to remove those appearances from the category of ordinary ghost stories ; in each case there would be hallucinations, and nothing, so far as we can see, to choose between them. The union of the two natures, divine and human, is one which in some respects passes our comprehension, but, if once admitted, it makes the difficulties, so elaborately discussed by modern critics, of comparatively small weight.

The question of the credibility of the documentary statements also affects other doctrines which are distinctively Christian, but after what has been already said on this subject, it may suffice to inquire, whether any difficulties, which they may involve, have been increased or diminished by recent advances in scientific knowledge. From that standpoint we cannot expect, as a rule, to find much in common ; still, illustrations may be supplied by our widened experience which tend to bring the abnormal into closer relation with the experiences of our

[1] J. M. Thompson, *ut supra*, p. 210.

ordinary life. We read, for instance, in more than one part of the New Testament of certain remarkable phenomena which are ascribed to the direct action of the Holy Ghost—such as the conspicuous effect on the Day of Pentecost, when the mission work of the infant church may be said to have begun, and those subsequent manifestations, which St. Paul enumerates in his First Epistle to the Corinthians.[1] Phenomena such as these are not consistent with ordinary experience and present exceptional difficulties to any who seek to study them from a scientific standpoint, but, anomalous as some of them undoubtedly are, we are becoming aware of the fact that in the human consciousness mysteries and abnormalities are more numerous and frequent than was generally supposed less than half a century ago. Manifestations of these are, unfortunately, often associated with much chicanery and imposture; the study of them demands exceptional care and certain qualities which are not necessarily developed by experimental work in a chemical or physical laboratory, as we have already said; nevertheless, there is a foundation of fact in the phenomena associated with hypnotism, thought-transference, mental telepathy, a double consciousness in one individual, the action of the so-called subliminal self, and the like, which is very difficult to explain or to bring into line with those inductions from observation which we designate as the laws of nature.[2] If there can be epidemic forms of hysteria and insanity; if the effect of these is to give abnormal physical strength and endurance, and to produce effects on the body through the action of the mind, we cannot think it surprising, if impulses of a like nature,

[1] 1 Cor. xii. 4–11. [2] See Chapter v.

but of a different character, should produce results that are beneficial; that good influences, as well as evil ones, should sometimes be epidemic. Though we cannot, at present, consider such things to be more than probabilities, it is at any rate evident that we must be more cautious than heretofore in refusing to take account of phenomena which we are unable to explain. A somewhat sceptical attitude is no doubt justifiable, even necessary, in regard to them, for they afford opportunities to the clever impostor and knave, but it is well to remember that even now, wise as our generation may have become, "there are more things in heaven and earth than are dreamt of in [its] philosophy."

Christian doctrines relating to sacraments must lie outside the field of science, except they be expressed in terms of the concrete. That is the case with one maintained by an important section of the Church—the doctrine commonly called transubstantiation, which asserts that in the Eucharist the accidents, as they are technically called, of the bread and wine remain unaltered, but the substance of them is changed into the substance of the body of Christ. This dogma is founded on the postulate that, in every inanimate object, such for instance, as bread, there is, besides its accidents (such qualities as taste, odour, consistency, chemical composition and the like) something—the substance or hypostasis—which makes it that which it is. But if the substance be more than a mental concept, these accidents are simple indications of its relations to its environment. For example, if we take water, by way of illustration, as being simpler in its composition than wine or bread; this is formed by hydrogen and oxygen entering

into chemical combination in the proportion of two to one. Prior to that event hydrogen had its own substance, whatever that might be, and so had oxygen. The act of combination gives rise to a new substance. But this substance—H_2O—under ordinary atmospheric pressure is solid when the temperature falls below 32° F., passes into vapour when this rises above 212° F., and is a fluid between these limits. Each of these conditions is recognizable from its own group of accidents, but the substance of H_2O, whatever it be, must be the same, since to imagine this special compound of oxygen and hydrogen to be solid at a temperature of 122° F., would be no better than a chemical nightmare. An hypostasis of that sort, which can divest itself of its accidents and transfer them to another hypostasis, like a man taking off his clothes, may or may not be good in metaphysics, but it is bad in science, the students of which have a right to criticize whenever the theologian begins to deal with the phenomenal universe.

In regard, however, to one great Christian Doctrine —that of the Trinity—though it is strictly metaphysical, scientific progress has done a little to diminish its obvious difficulties. The existence of three Persons in one Godhead—as asserted in the Latin creed, which passes under the name of Athanasius, or in the more exact Greek form, *τρεῖς ὑποστάσεις ἐν μίᾳ οὐσίᾳ*—became necessary, when once the Divinity of Christ and still more of the Holy Ghost was maintained by His followers, in order to avoid a relapse into polytheism. Though this is a noetic conception and thus does not belong to the region of the phenomenal, the latter presents us with some analogies which make the assertion of the Trinity

in Unity rather less startling. For instance, among minerals, cases are familiar where the same chemical compound may assume more than one form, each of which is conspicuous and persistent. The physical properties of these—hardness, action upon light, heat, and, electricity, the geometrical relations of their outward shape and their inward structure—may be all different, though chemically they are identical. The diamond and graphite (the material of 'black-lead') are both carbon; yet they belong to different crystalline systems; the one is the hardest, the other almost the softest of minerals; the one is generally transparent, the other always opaque. Silica (SiO_2) also occurs (even if we put aside its colloidal state as opal) in at least two distinct crystalline forms with their own peculiarities; titanic acid (TiO_2) assumes three crystalline forms, two of which, however, belong to the same system, but each has its distinctive characters, and similar cases might be cited from minerals, the chemical composition of which is less simple.

When we pass from the inorganic to the organic side of Nature a distinct individuality seems at first sight indispensable. But in plants this individuality is sometimes capable of being separated by a process very different from that of ordinary reproduction. For instance, a slip may be cut from a plant which, when put into the ground and properly fostered, becomes as complete an individual as that from which it was detached. Or one of the twigs of a shrub, after having been pegged down to the ground, presently begins to throw out roots and shoots, after which its connexion with the original plant can be cut and its individuality is then complete. If, however, we are met with the objection that we cannot

attribute consciousness to plant-life, we may find some analogies in the animal world. Here, also, it is very difficult to define individuality among some of the lowest organisms. They seem to separate whenever that becomes convenient, and then, after living apart for some time, and it may be producing new individuals, are said again to coalesce and become a single one. But, besides this, a combination of diversity and unity is also shown by rather more highly organized animals, such as some of the *Cœlenterata*.[1] Here several members of the class *Hydrozoa* are composite in form, consisting of a number of polypites[2] connected by a common tissue, "the one being related to the other, to use a rough simile, as buds just bursting from the bark are to the woody axis of a branch. The life of the whole colony is a common one, yet it is individualized in each polypite." Nevertheless the importance of that apparently unorganized common tissue is emphasized by the fact that, in some cases, reproduction takes place, not from the polypite, but by the formation of a new and separate group of structures at some part of the common, but less highly differentiated, stem. The corals also, which belong to a class (*Actinozoa*) of the same sub-kingdom rather above the *Hydrozoa*, occur sometimes as separate polypites, sometimes as a group of polypites, united, as above, by a common tissue. But in all of them it is difficult to separate the more highly from the less highly specialized tissues in an individual, or, in the case of a compound form, to say when the one individual ends and another one begins.

[1] The second great subdivision of the animal kingdom.

[2] The name which designates a complete individual in the association.

The difference apparently is one of form and arrangement rather than of actual substance. Reproduction in this class—the *Actinozoa*—may take place in more than one way, and of these the following one is suggestive. A single polypite gradually separates itself into two, or even more, individuals, each of which ultimately becomes complete in itself. If we try to follow in thought the gradual change from one single life to two individual lives, the continuity of existence between these states brings us in the course of it to something very like two aspects of a common essence " facing inward upon themselves as well as outward upon the world."

To these analogies an objection may be made, which seems at first sight reasonable, that we find them only among the lowest forms or in the lowest stages of organized creatures. But may not this objection be more apparent than real. In all living creatures the distinctive characters of each are determined, by what means we cannot say, at a very early stage in their existence. At a time when the absence of definite characteristics in the embryo makes it impossible for us to predict to what position in the animal kingdom it will ultimately attain, that position is already determined. The future organization is latent—potentially present in the embryo. One will become a dog, another an ape, a third a man ; [1] there are differences in the apparently uniform, complexities in the apparently simple, though to us they are imperceptible. On the inorganic side of Nature also our studies carry us back from specialized to simple forms, from the molecule to the atom, from the atom to the corpuscle,

[1] Of course a similar statement may be made of the germs in seeds.

from the various modes of matter to the results of energy, acting on something which apparently is perfectly uniform. Yet, if we reverse the process, we can form a mental picture of all forms of matter, which are known to us, emerging by a process of evolution from this elementary stage along separate lines of development which have apparently been predetermined. May not this also be true of organized creatures, that these, when traced back, lead us ultimately to a protoplasm in which was " the promise and the potency of all terrestrial life ? " We must remember also that in the world of which our senses can take cognisance, it may be said that the paths of specialization, like those " of glory lead but to the grave." The more highly organized animal is the more easily destroyed, so that the very specialization, which is the outcome of its having adapted itself to its surroundings and is rewarded by a temporary prosperity which tends to carry the process yet farther, makes an alteration more difficult, so that at last the organism may perish from an inability to respond to any further change in its environment.

It is also possible that development and specialization may be restricted to the temporal order and have no place in that which is eternal. " The thing with its potentialities, the thing with these accomplished, may be one in the sight of Him in Whose order time and space may have an existence which is equally objective and equally subjective. If, to express our meaning, we fall back for a moment on a platonic phrase, we may say that the pretemporal form in the Divine Mind admits of no comparative terms, and that in the progress from the monad to man, just as in the progress from the embryo to the

adult, we may only be witnessing its evolution in the order of the temporal and the phenomenal. Organization, specialization, may be only the focussing, as it were, of the archetypal idea on the screen of the material; the image grows distinct before our eyes, yet it might be said to exist in reality, though it was not perceptible by our senses, at every stage of the process." [1]

Our ideas of time and space, of the sequence and diversity of actions, may be founded upon our own limitations rather than be inherent in the Divine Nature. Our conceptions of that may be due to man projecting himself into God even more than to God revealing Himself to man. We must in any case remember that these conceptions of Him, Whom the eye of man cannot see and the mind of man cannot comprehend, are conditioned by restrictions which can find in Him neither place nor congruity. We are thinking, speaking, and describing, in terms derived from one order, about another to which they are not applicable, and thus are in much the same position as a mathematician would be who was endeavouring to find a solution of a very difficult problem by means of a calculus which was inadequate for that purpose.

[1] The author, *Christian Doctrines and Modern Thought.* Lecture III, *The Holy Trinity*, pp. 41–60.

CHAPTER VII

REPRESENTATIVES OF CHRISTIANITY AND WORKERS IN SCIENCE

THE attitude of religion to science, or rather of the representatives of the one to those of the other, since the time when the Roman Empire became nominally Christian, remains to be considered, and it is not a subject which the friends of religion, that is, those who place a higher value on the attainment of truth that the success of a party, can regard with much satisfaction: Too often the Church has opposed, denounced, and persecuted, men whose only offence was that they endeavoured in singleness of heart to find a correct answer to some riddles of the universe and questioned the validity of decisions which were founded, not on the matured conclusions of students, but on the prejudices of the ignorant.

Scientific investigation, as a rule, was unshackled in the days when the Roman Empire was still pagan, and no serious attempts to restrict its progress were made till Christianity had triumphed and the rulers of the Church were able to guide the sword of the state. The fall of the Western Empire indirectly augmented their power when the inroads of vigorous but ignorant races had almost effaced its effete civilization. After the first epoch of rapine and ruin had passed away, the

Church found itself confronted with so gigantic a task—the conversion of a pagan world—that it might well have been appalled. Still, this time it had two advantages—the prestige of its past history and the opportunity, in many parts of the ancient Empire, of calling to its aid a remnant whose devotion to the cross had never wavered through trial and tribulation. Thus, the clergy, in many districts, were the chief representatives of every reforming and humanizing influence, the few men with any pretensions to learning among a crowd to which books were strange secrets, and the arts, except those connected with warfare, were almost mysteries. They had also the advantage of retaining, amid an imperfectly organized community, the old system of order, law and discipline, to which Imperial Rome had owed much of its greatness. They had not to devise and invent, but simply to adapt and keep going, machinery with the working of which they were already familiar. Thus the clergy obtained the influence which knowledge, if it has the opportunity, never fails to gain over ignorance and became credited with the powers that were once attributed to magicians. But it is needless for our present purpose to dwell on the gradual increase of the authority of the Church and the supremacy of the Bishop of Rome. The former was a great civilizing force, but the more autocratic it became, the more the powers of its clergy were increased and those of its laity diminished, the less faithfully did it carry on its Master's work in the world, the more it became a tyranny which in some respects was more insupportable than that of the Roman Empire in its worst days.

So the story of its efforts, in medieval and later times, to stifle scientific inquiry and to persecute those who

were seekers after truth, is neither a pleasant nor a creditable one, but it must not be passed over, because, though the evil spirit of ecclesiastical intolerance may have been scotched, it is not yet killed, and until the representatives of the Church make a frank confession of past errors and publicly abandon the claim to decide questions which they have not studied, that spirit will continue to lurk in secret places, still ready to resume, on the first favourable occasion, its attempts at tyranny.

That story has been told, in considerable detail and with ample references to the needful authorities, by Dr. A. D. White, Principal of Cornell University, in a volume entitled *The Warfare of Science*, on which I mainly rely for the following statements, following the classification of the subjects which he has adopted.

Geography was the first battlefield. The earth in very ancient times was generally supposed to be a disc, with the ocean flowing round its margin. Plato, however asserted its globular form and Cicero refers to his opinion and speaks of the antipodes.[1] Ideas of this kind became more generally entertained as time went on, but were unfavourably regarded by Christian writers. Lactantius, in the earlier part of the fourth century, speaks of the absurdity of supposing that men's feet could be above their heads, or rain fall upwards. Augustine,[2] while admitting that the earth might be a globe, maintained that the antipodes were uninhabited, because 'Scripture speaks of no such descendants of Adam.' Many of the

[1] Plato, *Timæus*, c. 62 : Cicero, *Acad. Quest.*, iv. 39 ; *Tusc. Quest.*, i. 28, v. 24, and Sir G. C. Lewis, *Astronomy of the Ancients* (1862), ch. iii.

[2] 354–430 A.D.

Fathers of the Church considered a belief in the rotundity of the earth to be incompatible with salvation, though St. Basil and St. Ambrose took a more lenient view of the error.

Cosmas Indicopleustes was supposed to have confuted the innovators in the next century ; but over his extraordinary hypothesis of the structure of the earth and solar system it is now needless to linger. Yet his absurd system, constructed [1] from literal interpretations of poetic phrases in the Scriptures, for long impeded the advance of scientific study, for " the greatest minds in the Church devoted themselves to buttressing it with new texts and throwing out new outworks of theological reasoning." Two centuries later, even Boniface, the evangelist of Germany,[2] called on the Pope, apparently with success, to silence Bishop Vigilius of Salzburg, who had expressed a belief in the antipodes ; and Columbus, when planning his famous voyage, was attacked by theologians at the Junta of Salamanca, with texts and quotations from St. Augustine. He went, and saw, and returned, but notwithstanding this Pope Alexander, in 1493, assumed the earth to be flat when he drew a line of demarcation between the Spanish and Portuguese discoveries, and even after Magalhaens [3] had demonstrated its rotundity.

Astronomy fared no better than Geography. The Ptolemaic doctrine that the earth was the centre of our

[1] He wrote about 547 A.D. For a full account of his hypothesis, see A. D. White, *The Warfare of Science* (1877), pp. 14–17.

[2] The dates given for his martyrdom vary from 753 to 755 A.D.

[3] He was killed in the Philippine Islands (April 27, 1521), after passing through the Strait which bears his name and crossing the Pacific, but his ship was safely navigated back to Spain, whence it had started.

planetary system for long found favour with theologians, because it was in accordance with the words of Scripture, and when Nicolas Kopernik, as a result of more exact observations and improved mathematical processes, had convinced himself that the sun was the central body of that system, he had great difficulty in finding a publisher for his book, which did not appear till he was on his death-bed. "It was taken in hand by the proper authorities and in due time solemnly condemned; to read it was to risk damnation, and the world accepted the decree." The Copernican theory was no less strongly denounced by Protestants (Martin Luther and Melanchthon being conspicuous among them) than by those obedient to the Pope. Galileo also, whose improved telescope had shown that an apparently serious difficulty in the Copernican theory did not really exist, was for long the victim of persecution [1] on account of this and other unwelcome discoveries. He was silenced, exiled, imprisoned, and his body after death was excluded, for about a century, from the family vault in Santa Croce. Even the existence and motion of spots on the sun, another discovery of the obnoxious telescope, was a forbidden subject in many Roman Catholic schools and Universities, and the teaching of it was not formally sanctioned till 1822. Kepler [2] made the next great advance, but was denounced and persecuted by Catholics at Rome and Protestants in Styria and at Tübingen; his steps, however, were followed and his reasoning carried farther by Newton, Halley, Bradley and other great leaders of science, so

[1] A. D. White, *ut supra*, pp. 30–32. Some of the details in the history of the persecution of Galileo may be disputable, but not the main facts.

[2] 1571–1630 A.D.

that victory remained with the Copernican theory, though even Bossuet, the eagle of Meaux, declared for the Ptolemaic as the scriptural theory, and, in 1746, Boscovich, the great mathematician of the Jesuits, used these words : " As for me, full of respect for the Holy Scriptures and the decree of the Holy Inquisition, I regard the earth as immovable ; nevertheless, for simplicity in explanation, I will argue as if the earth moves, for it is proved that of the two hypotheses the appearances favour that idea."[1]

Chemistry and Physics were also condemned by the spiritual authorities, not always, it must be admitted, without justice in the case of the former ; for some of those engaged in investigating the properties of drugs and metals were the reverse of reputable. But the charge of sorcery, which was a favourite missile against even the most eminent, was wholly without justification. " The list of great men charged with magic, as given by Naudé, is astounding. It includes every man of real mark, and the most thoughtful of the Popes, Sylvester II (Gerbert), stands in the midst of them." The authorities of the Dominican order oppressed Albert of Bollstadt,[2] ' the most renowned scholar of Germany.' Roger Bacon,[3] whose book, *Opus Majus*, may be considered, according to Dr. Whewell, the *Encyclopædia* and the *Novum Organon* of the thirteenth century, notwithstanding the friendship of Robert Grostête, Bishop of Lincoln, was hooted down in Oxford, cited to Rome, more than once imprisoned and his investigations were virtually forgotten.

Anatomy and Medicine fared no better. The Church

[1] A. D. White, *ut supra*, p. 67.

[2] The date of his birth is uncertain. He died, an old man, in 1280.

[3] Born about 1214, died about 1294.

from its earliest days seems to have entertained a distrust of them. Tertullian suggests that a skilful surgeon of his day was no better than a butcher; Augustine censures medical men, who are called anatomists, for dissecting corpses to 'learn the nature of disease and how it might be cured,'[1] and this distrust waxed rather than waned in the Middle Ages. Pope Innocent III, in the beginning of the thirteenth century, forbade the clergy to practise surgery, and Pope Honorius took the same course in regard to medicine. The Dominicans, in 1243, banished books on that subject from their libraries and Pope Boniface, at the end of the century, interdicted dissection as sacrilege. Andreas Vesalius, author of a great book on anatomy, published in 1542, was often bitterly assailed for presuming to know more than Galen. Similar outcries have been raised in later days. Early in the eighteenth century inoculation for smallpox began to be practised. The French theologians of the Sorbonne solemnly condemned the practice, and in Protestant England it was denounced from pulpits in much the same terms. A similar outbreak followed the discovery of the protective effects of vaccination,[2] which was denounced as 'bidding defiance to Heaven itself—even to the will of God.' In the middle of the last century, when Simpson recommended the use of anæsthetics, especially in midwifery, "From pulpit after pulpit such a use of chloroform was denounced as impious," because its aim was "to avoid one part of the primeval curse on woman."[3]

[1] Tertullian, *De Anima*, c. 10; Augustine, *De Civitate Dei*, xxii., c. 24.

[2] Jenner's discovery was made known by a memoir published in 1798.

[3] A. D. White, *ut supra*, p. 109.

This clamour, however, soon died of its own absurdity, and there is good ground for hoping that it will never be revived, for of late years both clergy and laity, but notably the former, have frankly recognized the blessings that have resulted from improved therapeutics, especially in regard to disinfectants and antiseptics, and from the advances in surgery, and have often taken the lead in promoting sanitation, in the better housing of the poor, in urging upon parents and all connected with the upbringing of children, the importance of cleanliness, of fresh air and of a wholesome diet. They have made it their business to secure proper nursing and due medical care for the sick, and to lighten the burden of ill-health. For these purposes they have given largely of their time and, where possible, of their money; they have striven to understand the needs of the labourer in the country, the worker in the mine, and the artisan in the city, and to become their helper and friend. So strongly, indeed, has the current set in this direction that perhaps zeal may occasionally outrun discretion, and enthusiasts, especially among the younger clergy, be apt to forget that the complicated problems of modern civilization require for their solution something more than a fraternal ardour and an enthusiastic optimism. Still that is better than shutting the eyes to painful facts and maintaining that whatever is, is best.

Geology, with the associated parts of Biology, has been, till very lately, with many supposed defenders of religion, a favourite subject of denunciation. Some asserted fossils to be ' sports of nature ' or ' results of a seminal air acting upon rocks,' or ' models, made by the Creator before He had fully decided upon the best manner of

creating various beings.' It was even suggested that they were made and placed in the earth as a trap for over-inquisitive souls. When it became impossible to deny that fossils were the relics of creatures which once had been alive, they were supposed to be relics of the Noachian deluge. After this explanation proved to be inadequate, various efforts were made to force the results of geological investigation into harmony with the account of the six days of Creation in the opening chapters of Genesis. Men are still living at whom, in their earlier manhood, the old missiles—charges of infidelity and atheism—were frequently hurled ; [1] and when the alarm appeared to be subsiding it was again aroused by discoveries which indicated that man must have existed on the globe for a much longer period than the Ussherian chronology would allow. Particulars of this have been given in an earlier chapter, so that it may suffice to say that the old missiles were again collected from the old fields of defeat. Some assailants asserted the stone implements to be the results of natural fracture ; others declared them to be modern forgeries ; others again sought to prove that the geological evidence did not indicate any great antiquity. At the present day no one would dispute them to be the work of man and made many thousands of years ago.

But another and even greater conflict had already begun. In 1859 Charles Darwin published the *Origin of Species*, in which, as has been already described, he maintained this to be the result, not of special creation, but of a process of evolution. The book was quickly denounced,

[1] The story of the earlier opposition has been written by Charles Lyell (*Principles of Geology*, Book i., ch. 2–4) and A. Geikie (*Founders of Geology*, more especially ch. ii.).

on account, not of insufficiency of evidence, but of its supposed irreligious tendencies, from pulpit and platform by hundreds who often were quite incapable of understanding its arguments. It would be a waste of time to follow the details of the conflict, the most dramatic episode in which occurred at a meeting [1] of the British Association in Oxford, when Samuel Wilberforce, the Bishop of that Diocese, made an attack upon the hypothesis which exposed him to a crushing retort from Professor Huxley. Since that date the great advances in our knowledge of the natural sciences have shown that Darwin was right in regarding new species as the outcome of evolution, though many careful students believe that he attached too much importance to the action of natural selection, as he termed the weeding out of forms less able to cope with adverse influences. Alternative explanations have been offered by Weissmann, Mendel, and other biologists. One indeed was subsequently proposed by Darwin himself—but whatever may be the result of this controversy (which is not yet decided) the main fact—that species are the outcome of a process of evolution and not of special creation—is now not only regarded as well established, but has been extended, as we have already shown, to other aspects of the earth's history, not excluding civilization in its varied aspects and even religion.

An attempt was subsequently made to force theology into antagonism with science, by means of an address [2]

[1] It was in 1860. See *Life and Letters of Charles Darwin* (1887), vol. ii., pp. 320–322 ; *Life of Huxley*, vol. i., p. 194 ; *Life, Letters and Journals of Sir Charles Lyell* (1881), vol. ii., p. 335. Reference is made to this in another connexion on p. 172, note.

[2] It was circulated among the clergy early in 1864, and is often called the 'Oxford Declaration.'

to the Archbishops and Bishops, in which it was asserted (in apparent forgetfulness of the Sixth of the Articles of Religion) that the Church of England " maintains without reserve or qualification the inspiration and Divine authority of the whole Canonical Scriptures, as not only containing, but being the word of God." This address was supported by leaders of the older ' Evangelical ' and younger ' Tractarian ' party in the Church, and received many signatures, but fortunately men were found among the clergy, who were clear-sighted enough to realize the consequences which it would entail, so that the abstentions and the protests were numerous and weighty enough to deprive the document of any real force. Had it been adopted, it would have been a formal declaration of war against science by the Church of England and a fertile source of infidelity.[1] In this respect, however, the changes which those have witnessed, whose memories go back for at least half a century, are very encouraging. All the contributors, not only the more advanced, to *Essays and Reviews* (1860), were strongly denounced ; yet few, if any, Biblical scholars would now endorse the views of inspiration maintained by writers in *Aids to Faith* (1861). *Lux Mundi*, though some of its essayists take up a fairly advanced position, disturbed a much more limited field, while those assumed in *Foundations* (1912), though they have offended some people, have caused no general ferment.

Of the two great parties mentioned above, the older—the Evangelical—was losing its influence in the earlier

[1] The length to which some of its advocates were prepared to go may be inferred from a pulpit utterance by the late Dean Burgon. *Inspiration and Interpretation* (1861), Serm. iii., p. 89, Cf. Serm iv., pp. 93, 94.

part of the nineteenth century, owing to grave defects which had been inherent from the first—namely, exaggerated individualism and neglect of the corporate character and continuity of the Church. The leaven of indifference and self-seeking—the legacy of the spiritual deadness and the grossness of living, so characteristic of the greater part of the eighteenth century—had again begun to work and a torpor was once more stealing over the life of the nation. Against this and the rise, especially in Germany, of a school of criticism, mainly destructive, the Tractarian or Oxford Movement was a protest (the latter name indicating that the majority of its first leaders were members of that University). But though its earlier effects were often of the highest value, it has developed in a way which some of those leaders failed to anticipate and of which they have disapproved.[1]

This was because in their anxiety to emphasize the continuity of the Anglican Church with that of Primitive, but post-Apostolic times, they had sought to cure the evils of the present by the resuscitation of a past which, after all, was in many respects visionary, and they had forgotten that in all healthy life there must be "a putting away of childish things, an atrophy and elimination of the outgrown, an adaptation of the whole organism to higher conditions."[2] The logical outcome of their principles was exhibited by John Henry Newman (afterwards Cardinal) in his *Essay on Development*, written to justify

[1] See F. Meyrick, *Memories of Life* (1905), p. 97 (on Dean Burgon) and p. 137 (on Bishop S. Wilberforce). How these principles have been developed may be seen in *The Crisis in the English Church*, by the Rev. the Hon. W. E. Bowen (1900), p. 88, etc.

[2] The author, *Evolution in Religion* (a sermon), 1909, p. 9.

his secession to the Roman Communion. This book has led some to praise him as the first to recognize in theology a process of evolution. To myself that assertion seems to imply a very limited view of what the latter process really meant. Newman had forgotten that in the Christian Church, even at the period when its intellectual conceptions were being developed to an extent and with a precision which might fairly be designated an evolution, there were other and almost simultaneous developments which were distinctly atavistic. He had also failed to realize that, in questions of religion, inductive methods are useful and even necessary checks on the results of deductive reasoning. "The world is the laboratory in which conclusions are tested, and history the record of the results. When the former are repudiated by our moral sense, and the latter are obvious failures, we are justified in inferring, if satisfied with the soundness of our logic, that our axioms must be defective." [1] Neglecting this precaution, rigidly logical except for an occasional lapse into unconsciously begging a question, Newman was driven to conclude that the Roman Church was right in the main issues between it and the Anglican, and took the inevitable step of secession in which he has found numerous followers.

The last few years have witnessed the rise of a third movement—to which some reference has already been made [2]—that often collectively designated Modernism. Its leaders would probably regard it as an onward step in the evolution of religion, and this, to some extent, is true, but I venture to doubt whether it is more than a very incomplete and imperfect representative of evolution. Christianity differs from other religions in being built on a

[1] The author, *loc. cit.* [2] Pages 158–173.

foundation of history ; it differs in this respect even from Judaism, because a member of that creed, while rejecting the account of the Saviour which is given in the New Testament, might fully believe Jehovah to be the guardian and guide Who had more than intervened to deliver his nation in a time of special peril. But the basis of Christianity is the history of a Person, Who for more than thirty years lived as a man among men, and yet was not only a man, like Moses, or Elias, or one of the greater prophets, but could be called in more than a figurative sense the Son of God. This Person is stated in our Creeds to have been born of a Virgin, to have been crucified under Pontius Pilate, and to have risen from the grave. The second of these statements is not disputed, but the first and third are now regarded with increasing disfavour. We have already referred to them, so it may suffice to say that, if the well-known phrase, ' miracles do not happen,' cannot be accepted as axiomatic, if the first word be used in its ordinary sense, we may fairly ask what really did happen to originate the belief in the Resurrection and what explanation can be given of the extraordinary rapidity with which this belief was accepted by the infant Church. That the story should be a deliberate falsehood is most unlikely, because the leaders of that Church, though they might not be infallible, were obviously men who would have scorned anything of that kind. The vision of the Lord may have been an hallucination, but if so, the number, both of the times when it occurred and of those affected by it, is certainly remarkable. If the tomb on that Easter morning was not empty, or if the body had been secretly removed and buried elsewhere ; if, in the ordinary sense of the words, " the ashes of Jesus mingled

with the dust of Palestine," one would gladly learn what is to be substituted for the belief, which from the earliest days has been a chief foundation stone in the edifice of Christian doctrine, and in what respect our hope of the life to come is more sure and certain than it was among the Jews nineteen centuries ago, or what advantage we have over them, beyond possessing a higher code of ethics and a more perfect ideal of humanity. When seeking for information on this point, when asking for at least a working hypothesis to replace the belief which we are bidden to discard, we may reasonably expect something more definite than vague phrases and a mist of words. The Resurrection, no doubt, is an event unique and contrary to general experience ; its difficulties are obvious to every student of science, yet notwithstanding these it may be true. But the training he has received will, I think, actually aid in convincing him that this belief, so far from being an encumbrance, which can readily be cleared away from Christianity, like ivy from a tree, is really so vital a part that the excision of it would almost certainly prove fatal.

We have been told, of late years, that ' Christianity is at the Cross-Roads,' but if so, the true course will be not to take either the turn which leads to Medievalism or that to Modernism,[1] but to keep straight on along the path of evolution ; that, as we have already indicated, will need no little courage, energy, and labour, in discarding the outworn and eradicating the recrudescences of Judaism or even Paganism, which from an early period have

[1] These really follow opposite directions, so that attempts to combine the two, such as may be found in the *Diary of a Modernist*, by W. S. Palmer (1910), are not likely to produce any better result than fostering a vague and unpractical sentimentalism.

been no small hindrance to the growth and progress of the Church of Christ.

It must, however, be remembered that the less organized condition and the absence of such a definite central authority as that of the Roman Communion have, to a considerable extent, prevented the Reformed Churches from so definitely committing themselves to a position of hostility to science, and there has been among these, especially during the last hundred years, an increasing number of men who neither shared the general timidity nor joined in the popular clamour. In England not a few of the leaders in Geology during the earlier part of the nineteenth century were in Holy Orders, and though, from time to time, they were attacked in the usual way, by ignorant critics, lay and clerical, they were not excluded from preferment. W. Buckland became Dean of Westminster; W. O. Conybeare, Dean of Llandaff; W. Whewell, Master of Trinity; Adam Sedgwick, the veteran Cambridge Professor, held also a canonry at Norwich. J. S. Henslow, the Professor of Botany (he had previously been Professor of Mineralogy and was a good geologist), did not rise above a country living;[1] but W. Vernon-Harcourt, President of the British Association in 1839, was a Canon of York. Charles Kingsley, a true lover of Nature, became a Canon of Westminster, and the tide during the later and larger part of the century set steadily and with increasing strength in the direction of freedom for scientific inquiry. But notwithstanding this, J. W. Colenso, Bishop of Natal, so late as 1863, was deposed by an ecclesiastical tribunal in South Africa for disputing the

[1] His recommendation gave Charles Darwin the opportunity of his life by joining in the cruise of the *Beagle*.

Mosaic age of the Pentateuch, and though he was confirmed by the law-courts in the possession of his see, was virtually censured by the English Bishops. Yet it is now admitted by many Biblical scholars that, whatever may be said of the methods and sundry details in Colenso's arguments, his main position—that the Pentateuch is a composite work, some parts being much more modern than others—cannot be gainsaid. Charles Darwin, notwithstanding the outcry against his *Origin of Species*, was laid to rest in Westminster Abbey only twenty-three years after it had been published; while Bishops with other clergy, in referring to that event, declared evolution to be capable of being reconciled with Christianity. In fact, for the last half-century the current of opinion, clerical and lay, has been steadily increasing in favour of recognizing the independence of science and theology, and the distinctness of these proper provinces.

We must indeed confess that though defenders of Christianity have often, in their unwise zeal, done mischief to their cause, advocates of science, especially of late years, have sometimes made a similar mistake. Of this a common reason has been the assumption that our present knowledge is not only the highest that can be attained, but also of such a nature that whatever cannot be discovered or tested by the instruments of our laboratories has no claim to be seriously considered. Those who adopt this position are right in believing that the risk of error in scientific investigation is less than in theological, and that, by the direct and repeated tests employable in the former, a different, and in some respects higher, degree of certainty is attainable than in the latter, but they forget that their precision of view is inevitably associated with

a limitation of knowledge. There may be ' more things in heaven and earth ' than are dreamt of in man's philosophy, and on some of these light may be thrown by other kinds of experiment than those made with instruments. There is, for instance, that of general experience. Evolution itself implies an elimination of the unfit as well as a survival of the fittest, and a study of the former process indicates the organic modifications which have proved disastrous to a race. Similarly we can perceive, by inductions from observations of mankind in the past how the development and prevalence of particular ideas and principles has proved beneficial or disastrous. That the child is father of the man is true in more than one sense, and this holds good in regard to civilized and uncivilized races. The study of both these provides criteria for testing the tendency and efficacy of any particular dogma, whether it be authorized by the general consent of scientific men or by the representatives of a Church. If we can prove that it has had a healthy influence on ethical and intellectual progress, that is good evidence in favour of its general truth, and the evidence becomes yet stronger if we can show that any partial failure is due to misunderstanding or misrepresentation on the part of its champions. We may fairly plead this on behalf of Christianity. It has often been wounded in the house of its friends, yet it has survived the follies of its advocates, the errors of its defenders, and the crimes which have been committed in its name. Notwithstanding these the world is a better place now than it was nineteen centuries ago, and Christianity has been more successful in producing this result than any form of philosophy, whether Greek or Roman, Stoic or Epicurean, whether that of the Brahman,

Buddhist, or Confucian. Thus even the methods employed in science warn its students not to forget their limitations or the fact that, outside the doors of their laboratories, they have to deal with a world in which the possibilities and the tests may be very different from those to which they are accustomed. A neglect of this warning may make scientific men not less dogmatic than theologians outside their own province, and the results may one day be as disastrous. Of this tendency one instance may suffice, for it is recent in date and uncompromisingly aggressive. Professor Ernst Haeckel, the author of the *Riddle of the Universe*,[1] which is read by tens of thousands and accepted by many of these as the final verdict of science on the fundamental questions in theology, declares theism to be a myth and religion in any form a vestige of primeval superstition. Its place must be taken by his system of Monistic Philosophy, the leading idea in which is that all being may ultimately be referred to one category. Regarded in this light "the universe, or the cosmos, is eternal, infinite, and illimitable. Its substance, with its two attributes (matter and energy), fills infinite space, and is in eternal motion. This motion runs on through infinite time as an unbroken development, with a periodic change from life to death, from evolution to devolution. The innumerable bodies which are scattered about the space-filling ether all obey the same 'law of substance'; while the rotating masses slowly move towards their destruction and dissolution in one part of space, others are springing into new life and development in other quarters of the Universe."[2] The statements are fol-

[1] See the concluding pages of ch. I.
[2] *Riddle of the Universe* (1906), p. 5.

lowed by others applying their principles to our earth and solar system, on which it is needless to dwell, because so far as they are strictly inductive they would be accepted generally by other workers in science. There are, according to Haeckel, two antagonistic groups, in which all the different philosophical tendencies may be ranged from the point of view of modern science. These " represent either a dualistic or a monistic interpretation of the cosmos. . . . The former breaks up the universe into two entirely distinct substances—the material world and an immaterial God, who is represented to be its creator, sustainer, and ruler. Monism, on the contrary (likewise taken in its widest sense), recognizes one sole substance in the universe which is at once ' God and Nature ' ; body and spirit (or matter and energy) it holds to be inseparable . . . so that matter cannot exist and be operative without spirit, nor spirit without matter." [1] It follows accordingly that any idea or hope of a personal immortality is vain and baseless, and it is not unjust to say of the Prophets of Monism that they have dismissed God from their system of thought as a provisional hypothesis which has served its purpose.[2] We may, however, be permitted to doubt whether Christianity, which is a special type of theism, is so entirely dualistic as Haeckel supposes. In its earlier days, when science was yet an infant and deductive reasoning almost unchecked by inductive, it was often expressed by its advocates in terms which laid it open to the charge of being uncompromisingly dualistic, and the ordinary forms of speech, even now current among its less thoughtful adherents, may still justify the accusation.

[1] *Ut supra*, pp. 7, 8.

[2] See Preface (by J. McCabe) to the *Riddle of the Universe*, p. v.

But the Early Church, followed by its more eminent leaders in later days, again and again condemned the dualistic principle and declared that God Himself called the Universe into being ; that its existence is a consequence of His will and a manifestation of His wisdom ; that He is the Author of all things, visible and invisible, of the darkness as well as of the light. The Christian, or the upholder of any definite form of theism, is no more fettered by the modes of thought and forms of expression, which found favour among his predecessors, than is Professor Haeckel by the science of ancient Greece, Rome, or Chaldea. To the Christian the existence of evil now presents much less difficulty than it did in former days, because he sees it to be, when regarded in the light of evolution, an almost inevitable consequence of a survival of the instincts and tendencies of a lower stage during the ascent to a higher one.[1] Christians really agree with the Monists in admitting that a great cause underlies the whole series of natural phenomena and that It is One and Eternal, but they maintian that there is and always has been a Mind and Purpose in, a conscious exercise of control by the Infinite and Eternal Energy. They dispute the fundamental assertion of Haeckelian Monism, called by its advocates Dysteleology, or the theory of purposelessness, which is their inference from the " survival of rudimentary organs, of suppressed and degenerated, aimless and inactive parts of the body . . . which when rightly estimated, is alone sufficient to refute the teleological and dualistic conception of Nature and to serve as the foundation of a mechanical and monistic conception of the universe." The German

[1] See the author, *Old Truths in Modern Lights* (1891), p. 269.

philosopher appears to some of his critics to fall into errors similar to those of which he accuses them, namely, of " not always distinguishing between statements of ascertained truth and mere unsupported hypotheses, of sometimes begging a fundamental question, or supplying inconvenient gaps in a chain of facts by unsupported guesses." He lays down the law, as if his decisions were infallible, yet, as we have already shown, some eminent physicists speak with little respect of his statements about their subject, and though his distinction as a biologist is admitted by his fellow-workers, some even of them maintain that he takes too much for granted in tracing his scheme of evolution.

Thus the Theist may maintain that inductive, not less than deductive, reasoning justify him in considering his creed to be at least as probable a solution of the ' Riddle of the Universe ' as the Monism proclaimed by Haeckel, and that the advocate of the latter system is constantly found to pass, unconsciously as it seems, from the region of the concrete to that of the abstract.[1] The book bearing the above-named title repeatedly attempts to beguile us into quitting the firm ground of observation and induction for that of metaphysical speculation and into discarding inferences which seem to be founded on facts ; such, for example, as the degradation or dissipation of energy, which must be rejected because it is contradicted by the Haeckelian hypothesis that the infinite and eternal machine of the Universe sustains itself in eternal and uninterrupted movement. This is a convenient mode of

[1] See *History of Creation*, vol. ii., ch. i. and iii. There is an able discussion of Haeckel's position in De Tunzelmann's *Electrical Theory, etc.*, ch. xxiv. (later part).

getting rid of a difficulty, but it is not one to be commended.[1]

But, unless we mistake, the bald and rather blatant atheism, proclaimed in the *Riddle of the Universe*, is losing ground with men of science and in educated circles generally and now finds its advocates chiefly among the smatterers and the ignorant. Not that its prevalence is on this account the less dangerous, because the tendency has been, now for not a few years, to place political power in the hands of the latter section of the community, and thus to make a convulsive outbreak of proletarian tyranny more easy than it was in former days.

A change also has passed, or is passing, over Agnosticism, a mental phase of which such men as Herbert Spencer, Tyndall and Huxley, may not unfairly be called the exponents. It was vigorous, and sometimes aggressive in the later decades of the nineteenth century ; it was a reaction from overconfidence and dogmatism in matters which are not only beyond the limits of human knowledge, but also do not form part of any revelation ; it has produced some good effects in checking tendencies distinctly mischievous, but '*ignoramus, ignorabimus*' is a motto which does not give a hopeful outlook on life and is not likely to stimulate to moral or even to intellectual effort. Agnosticism, however, now seems to be finding fewer adherents, to have become more reticent, and to be yielding place, among students of science, to some more or less definite form of theism, though at present they may not unfrequently maintain an attitude of suspense in regard to Christianity.

[1] For a full discussion of this and other weaknesses in Haeckel's methods, see De Tunzelmann, *Electrical Theory, etc.*, Appendix Q (pp. 617–625).

But I am sanguine that the more closely the earlier history and documents of Christianity are studied, the stronger its claims to acceptance will become (if we admit such a thing as revelation to be possible) as the most reasonable, ennobling, and spiritual of religions, and I hope that before our successors reach the middle of the present century they will have witnessed as great a change in the relations of science and Christianity as we have done in those of science and theism. But this will not occur, religion and science will not and cannot dwell together in unity, until it is frankly recognized that each has a different province. The boundary between these is not always accurately defined. There is a borderland, and the zone is sometimes a wide one, over which each has rights, but when once an aggressive spirit is banned and natural good-will prevails, the difficulties are capable of adjustment. This, however, will not and cannot be so long as an investigator in science denies the existence of anything which he cannot see with a microscope, test by a galvanometer, or scrutinize in a laboratory, or so long as the champion of religion usurps a position to which he has no valid claim. Formerly he too often was the aggressor and there will be no lasting peace till he has had the courage to admit past errors and to be more reticent in speaking of what he does not understand. Christians must, in short, cease to be actuated by the sacerdotal spirit, the leaven of which sometimes works in the layman as well as in the cleric, in the Protestant no less than in the Romanist.

The denominations in the Christian Church, whatever phase of opinion they represent, have repeatedly taken the side which experience has shown to be the wrong one,

That was so from a very early date, and matters grew worse when the Church became more and more formidable as a political force. Its powers in that respect have been curtailed, almost abolished, during the last century, but it has made no formal abandonment of its claims to an intellectual supremacy. In the Church of England, from time to time, the majority of the ordinary clergy, with some even of the bishops, followed by many of the laity, have clamoured against those who disputed canons of interpretation and definitions of inspiration which had no other warrant than the opinion of an individual or the voice of the crowd. Themselves ignorant of science, or with no more knowledge of it than an elementary text-book could impart, they have flouted and denounced some of its most earnest and able students, not a few of whom were Christians not less sincere than themselves, and a perusal of some of the letters, which appear from time to time in the so-called religious newspapers, is enough to show us that the spirit of arrogant intolerance, though it has been repressed, is not yet dead.[1]

Ecclesiastics in future, if they would maintain that influence which they ought to exercise in their own sphere, must frankly admit past mistakes and abstain from assuming that any gift of the Spirit, whether in ordination

[1] In case this be deemed a pessimistic view, I will quote from a paragraph in the *Guardian* (September 9, 1910) on the noble sermon by the Archbishop of York, preached at the meeting of the British Association in Sheffield, an extract from which is given at the end of this chapter. His Grace had said that a 'Truce of God,' now existed between Science and Religion. The editor asks, "Will this truce become a peace? We can only hope so. It depends much on the power of moderate men to control the extremists on both sides who are already showing some restiveness of an agreement they instinctively distrust."

or otherwise, will qualify them to speak dogmatically on questions which not only are difficult in themselves but also require a special training ; or from entertaining the delusive hope that the goodness of their intentions will save them from harmful errors. Facts, we must all remember, are very stubborn things. In science we may add to their number, fit them into place in their systems and better understand their relations, or the forces of which they are the result ; in history we may discover some which have long been forgotten and may appreciate their bearing on the evolution of religion and civilization ; but, however our interpretation of them may vary, however our perception of the laws working in them may become more clear, facts they will remain, or else they will be fancies on which, however pleasant or plausible, no structure can be erected which will endure the stress of storm. The priest, or other minister of religion, may hope and believe that, if he complies with the conditions under which all men, whether clergy or laity, must work, a special blessing will attend his efforts ; he may speak with the confidence of an expert on theological questions, provided he has carefully studied them ; but on those which lie outside his range of knowledge he has neither power nor right to claim any authority, or to pronounce a decision, in a matter which he has not investigated. When this position has been accepted, when each of the two recognizes the other's legitimate field of work, and both acknowledge that the God of nature is one with the God of revelation, there will be good hopes, not only of a lasting peace but also of harmonious co-operation.

Progress in this direction has been considerable, almost rapid, more especially during the last quarter of a century.

The relations of religion and science have been not infrequent subjects of discussion at Church Congresses, where men entitled to speak for the latter have frankly stated its conclusions, which have received from the leading clerics among the audience (though occasionally one of the rank and file has spoken unwisely) a hearty and generous welcome. Of the changed relations the meetings of the British Association afford no bad test. They are held annually, as every one knows, at some large town in different parts of the kingdom, and extend over a week, thus including a Sunday. When the Association met for the first time at York, in 1831, though it was favourably regarded by the Archbishop, one of whose sons acted as a local secretary, it was denounced (especially the Geologists) by the Dean, from the cathedral pulpit, and was for some time afterwards viewed askance by many ecclesiastics. Gradually, however, it grew in favour, and now receives from the leading clergy of the neighbourhood a hearty greeting. Of late years many notable sermons have been preached by either the Bishop of the diocese or other eminent ministers of religion. It may suffice to mention—as the writer happens to have heard them—the sermons delivered by Bishop Moorhouse at Manchester in 1887, by Bishop Browne at Bristol in 1898, by Bishop Carpenter at York in 1906, and by Archbishop Lang at Sheffield in 1910. The last-named prelate, in a discourse, not less remarkable for its eloquence than for its liberality and clearness of thought, referred expressly to the former hostility of religion and science, and welcomed the change which had taken place during the last two or three decades. His Grace so frankly adopted the attitude and endorsed the line of action which for years past I have done

my best, though in a much humbler position, to recommend to those zealous for religion, that I cannot find a more apt conclusion for this book than a short extract from the earlier part of his sermon :[1]

" We, who specially represent religion, and you, who specially represent science, meet in the House of God as friends. We are fellow-students of His Mind, as He reveals it alike in the movements of the human spirit and in the processes of the universe in which He dwells. We are fellow-disciples of the One Divine Teacher, the Spirit of Wisdom. . . . It is of the friendship of Religion and Science that I would venture to speak. There was a time when it would have seemed more natural to speak of their conflict. The middle of the nineteenth century was marked by the constant collision of scientists and theologians. . . . Of late years there has been a striking change. Another spirit has been working. There are still, in popular Press and platform, echoes of the old dispute ; still those who may be called the camp followers of Science and Religion are apt to break out into quarrels. But the truest and best men on either side are conscious that there is a call for truce—a truce of God, a truce to adjust misunderstandings, to retreat from rash and hasty claims, to think out their own positions more clearly, and to understand the position of those, who seemed to differ from them, with greater sympathy."

[1] It is printed in full in the *Guardian* (September 9, 1910). The sermon was preached in the Parish Church of Sheffield, and the service was attended, not only by the President and other leading members of the Association, but also by the Lord Mayor, with many civic authorities, who wore their robes and walked in procession to the Church from the Town Hall ; thus imparting to the occasion a special significance.

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